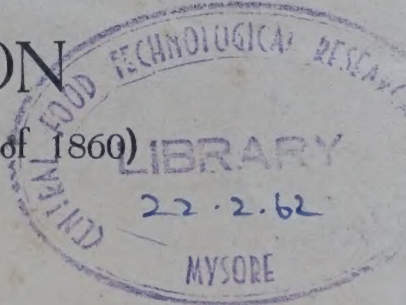


INDIAN SCIENCE CONGRESS ASSOCIATION
PROCEEDINGS OF THE
FORTY-EIGHTH SESSION
ROORKEE-1961
PART IV

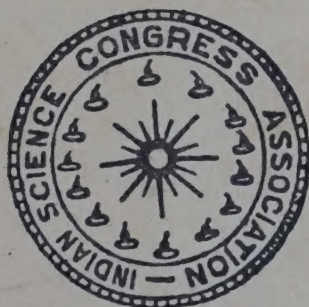
INDIAN SCIENCE CONGRESS ASSOCIATION

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PROCEEDINGS OF THE FORTY-EIGHTH SESSION ROORKEE-1961

PART IV
LATE ABSTRACTS, DISCUSSIONS, LIST OF MEMBERS
AND INDEX



PROCEEDINGS OF THE FORTY-EIGHTH INDIAN SCIENCE CONGRESS ROORKEE, 1961

PART IV

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PROCEEDINGS OF THE FORTY-EIGHTH INDIAN SCIENCE CONGRESS ROORKEE-1961

PART IV

LATE ABSTRACTS

Section I, Mathematics

The stability of a gravitating cylinder in the presence of Magnetic fields.

J. M. GANDHI, Bhilwara.

In this paper we study the stability of an infinitely long gravitating cylinder of incompressible, inviscid, and infinitely conducting fluid, in the presence of an axial magnetic field varying as $H_z \sim (R_0^2 - \gamma^2)^N$, N being a positive integer or a positive fraction or zero and R_0 being the radius of the cylinder. The field satisfies the conditions of "True-equilibrium", for all such N 's except when $N=0$. It has been shown that the present model includes Chandrasekhar & Fermi (1953) model and Auluck & Kothari (1957) model as special cases when $N=0$ and $N=1$ respectively. The transitional case with $N=\frac{1}{2}$ has been discussed in detail in this paper and it has been shown that the magnetic field increases the stability of the cylinder but the value of root mean square magnetic field within the cylinder is higher than that in the models considered by Chandrasekhar & Fermi, Kothari & Auluck but is lower than that in the models considered by Auluck & Nayyar (1960).

Section II, Statistics

1. Application of Sverdrup's Lemma to evaluate probability content of regions under normal distributions.

D. G. KABE, Dharwar.

Ruben (Ann. math. stat. 1960) has evaluated some integrals of the type

$$P(R) = (2\pi)^{-\frac{N}{2}} \int_{X \in R} e^{-\frac{1}{2} X'X} dX$$

by geometric-cum-analytic method. A rather unified derivation of his main results has been given by using Sverdrup's lemma (Skan. Aktur. 1947) and its modification

by Tikkiwal and Kabe (Karnatak Univ. Jour. 1958). In its modified form the lemma is as follows :

Let $X = x_1, x_2, \dots, x_n$ denote a Column Vector and B a given $q \times N$ matrix of rank q , then

$$\int_{-\infty}^{\infty} \dots \int_{-\infty}^{\infty} f(X'AX, BX)$$

$$X'AX = u, BX = v$$

$$= \frac{1}{2} C(N-q) f(u, v) |A|^{-\frac{1}{2}} |BA^{-1}B'|^{-\frac{1}{2}} [u - v'(BA^{-1}B')^{-1}v]^{\frac{1}{2}(N-q-2)}$$

Where $C(N)$ denotes the surface area of a unit N -Dimensional sphere. The applications of the lemma in classical univariate distribution theory have been noted.

2. An experimental investigation into the application of acceptance sampling inspection by variables to moderately skewed Pearson's Type III distribution.

N. K. CHAKRAVARTI and S. RAMASWAMY IYER, Kanpur.

Acceptance sampling inspection procedures by variables involve an assumption of normal distribution for the characteristics under observation. In practice little is known about the inherent distribution in the lot, but the same procedure is applied. In this paper, an investigation has been made regarding the effect of non-normality, by assuming two inherent Pearson's Type III distribution with $\beta_1 = 0.167$ and $\beta_1 = 0.50$.

Two distribution of the form of Pearson's Type III, of known skewness $\beta_1 = 0.167$ and $\beta_1 = 0.50$ are generated. An acceptance sampling procedure using $AQL = 0.02$ and $LTPD = 0.10$ is selected. Here $N = 34$ and $K = 1.6290$. 120 samples are drawn from the generated distributions and using the above plan the acceptability or otherwise of the lot on the evidence of each sample is determined. For any specified percentage of defective in this skew lot, the corresponding proportions of acceptances are determined. The sample estimates of the probability of acceptance are then compared with the probabilities under the normal assumption.

For a positively skewed curve, if defectives occur when $X > X_0$, an undue relaxation in inspection harmful to the consumer is the result. For the same curve, if defectives are defined as $X < X_0$, then an unnecessary tightening up of inspection is occurring to the dissatisfaction of the producer. Hence even for a moderately non-normal distribution, the normal sampling procedure leads to probabilities of acceptances that greatly differ from those assumed on the basis of normality of distribution.

3. The mathematical theory of biological assay when change in blood pressure is taken as response.

N. K. CHAKRAVARTI, D. D. BHATTACHARYA and M. N. GHOSH,
Kanpur.

So far, there is no satisfactory dose-response relationship between the doses of a drug and the resulting changes in blood pressure. Hence, the assays are mostly of a matching type, i.e., potencies are calculated by noting the concentration of a test preparation that gives responses equal to those when a known concentration of the standard is applied. A dose-response relationship is developed in this paper based on hydrodynamical principles.

The modified Bernoulli equation is

$$\frac{P}{w} + z + \frac{v^2}{2g} + \text{losses} = \text{const.}$$

Where P = the pressure exerted by a fluid, z = the height of the fluid above the given datum, w = the specific weight of the fluid, and v = the velocity of the fluid at the given instant.

The losses arise as a result of viscosity of the fluid, sudden contractions in the pipe and bends in the pipe. The total losses are thus

$$\text{losses} = \frac{v^2}{2g} \left[\frac{64 g \eta l}{D^2 v} + g w (K_c + K_b) \right]$$

Where η = the viscosity of the fluid,

l = the length of the pipe,

D = the diameter of the pipe,

K_c = the loss coefficient due to sudden contractions,

and K_b = the loss coefficient due to bends in the pipe.

Using the relation

$$Q = \pi D^2 v$$

where Q is the amount of the fluid flowing in a unit time, and considering Q to remain constant, that is, the cardiac output does not change, and also since in the case of blood pressure of a particular animal, η , l , and z are constants, we have

$$P = \frac{8 Q^2 w}{\pi^2 g D^4} \left[1 + \frac{16 \pi g \eta l}{Q} + g w (K_c + K_b) + 1 \right] + [\text{const.} - zw].$$

$$= A + B.D^{-4}$$

Where A and B are constants.

From the boundary condition that

$P \rightarrow 0$ when $D \rightarrow \alpha$, we have

$$A = 0,$$

Now, since in other situations, the equation

$$D = \alpha + \beta \log z + \gamma z$$

has been seen to give a good description to data where z is the dose, we have

$$P^{-1/4} = \alpha + \beta \log z + \gamma z.$$

An application of this relationship to data reported by various authors is found to give a good description of them.

The formulae for estimating the potency of a test preparation and the fiducial limits are also given.

4. Estimation of population parameters in a linear combination of two normal populations.

P. N. PHUTANE, Bombay.

Two normal populations with different means and different standard deviations are mixed together in some proportion. Estimates of the proportion, population means and population standard deviations are required from a random sample drawn from such a mixed population.

In this paper an attempt is made to estimate these parameters under certain assumptions. Two cases are considered :

(1) When the population means are equal and (2) when the population standard deviations are equal. Method of moments is used to obtain the estimates. The parameters are estimated from the central moments obtained from the sample.

Section III, Physics

SOUND

1. Propriety of dividing an Octave into twenty-two Shrutis.

H. V. MODAK, Poona.

The traditional Indian practice is to recognize only twenty-two Shrutis in an octave. The number twenty-two in which the octave is divided by the ancients has remained in practice unaltered till now, although satisfactory explanation is not found in the existing literature. This is perhaps why the division of the octave into twenty-two intervals has been considered arbitrary by many musicologists, who have written much against it.

A logical explanation is given in the paper which shows the significance of the number twenty-two in which the octave is divided on a nearly logarithmic scale. It is based on facts about which there can be no difference of opinion.

SOLID STATE OF PHYSICS

2. Cohesive energies and other properties of Ionic Crystals—I. Alkali Halides.

M. N. SHARMA and M. P. MADAN, Lucknow.

The lattice energies and other properties of ionic crystals have been studied on the basis of a Lennard-Jones (12:6) potential form and the necessary equations derived. Experimental data for the inter-ionic distances and lattice energies for such crystal have been used to give the values of the repulsive force parameter B and the van der Waals parameter C, which in turn have been utilised to obtain lattice energies, compressibilities and the coefficient of linear expansion. Satisfactory agreement is found between the experimental values and those calculated theoretically.

3. Cohesive energies and other properties of Ionic Crystals—II. Halides of Copper, Silver, Thallium and Ammonium.

M. N. SHARMA and M. P. MADAN, Lucknow.

Following the treatment employed in the case of alkali halides, the various crystal properties of other metal halides have been studied on the basis of a Lennard-Jones (12:6) potential energy form. Equations were modified to take into account the heavier metal halides, such as those of Copper, Silver, Thallium and Ammonium. The potential parameters have been evaluated and the various properties computed. The agreement between the theoretical and experimental values serve to justify the adequacy of the chosen potential form for those crystals also.

4. Theory of Solid Solutions of Alkali Halides.

T. P. DAS (Trombay), Bombay and B. G. DICK, Salt Lake City, U.S.A.

The relaxation around the solute ion in solid solutions of alkali halides is calculated for NaBr and NaCl, and KBr and KCl. Heats of solution and changes

in lattice constant are compared with those obtained by experiment. The nuclear quadruple interaction of nuclei adjacent to the solute is also calculated. Agreement with experiment is good for the positive ion nuclei but poor for the negative ion nuclei. The causes of the latter discrepancy have been discussed.

OPTICS & SPECTROSCOPY

5. On the emission spectrum of phenol.

B. R. DAS and N. L. SINGH, Varanasi.

The ultraviolet emission spectrum of phenol has been recorded and found to consist of about seventy bands in the region $2720\text{--}2940\text{ \AA}$. A tentative analysis has been made on the basis of fundamental ground state vibrations, 240, 393, 526, 625, 816, 832, 1002 and 1255. These are found to agree well with the Raman data.

6. On the absorption spectrum of M-Dichlorobenzene.

N. L. SINGH and D. K. GHOSH, Varanasi.

The absorption spectrum of m-dichlorobenzene in vapour state has been photographed on Hilger large quartz spectrograph. The spectrum lies in the region $2788\text{--}2470\text{ \AA}$ and consists of about 150 bands. The spectrum shows the features of an allowed transition which is expected on an assumption C_{2v} symmetry for the molecule. A tentative vibrational analysis is proposed in terms of two ground state frequencies 380 and 665 cm^{-1} and five upper state vibrations 368 , 962 , 1032 , 1092 and 3023 cm^{-1} .

ATMOSPHERIC PHYSICS

7. Some characteristics of sporadic E-Layer.

R. SATYANARAYANA, Tirupati.

Results of the studies made on the nature of the sporadic E-layer formed over Tirupati ($13^{\circ} 38' : 79^{\circ} 15'$) at different times of the day during April-May 1960, have been presented. In the method employed for this study, the amplitude variations of the reflected echo has been studied at different hours of the day and then analysed statistically. The form of the amplitude distribution curve for the echo is related to the nature of the reflecting surface. The conclusions drawn on the nature of the layer are also confirmed by noting the frequency range over which simultaneous reflections both from E_s - and F-layers are present. The following conclusions have been drawn: (a) during the early morning hours the nature of the sporadic E-region formed is of the 'ion cloud' type, (b) before ground-sunrise, a 'thin layer' type of E_s either alone or together with the 'ion clouds' has been formed regularly, (c) during the forenoon hours, the 'thin layer' type has been found to occur more often than any other type, whereas the mixed type of sporadic E is predominant in the afternoon hours. The possible agencies such as meteors, drifting ion clouds and thunderstorms responsible for the formation of these different types of layers at different hours have been discussed.

Section IV, Chemistry

INORGANIC CHEMISTRY

1. Studies on the steps involved in the preparation of anhydrous plutonium tetrafluoride starting with plutonium nitrate solution.

G. S. RAO, D. M. CHAKRABURTTY, A. V. HARIHARAN and
G. R. BALASUBRAMANIAN, Bombay.

The precipitation of plutonium (IV) oxalate from plutonium nitrate solutions has been studied from the standpoint of a typical fuel reprocessing cycle. The optimum conditions for efficient precipitation are described. The dry chemical conversion of plutonium (IV) oxalate to plutonium tetrafluoride has been studied. The small scale laboratory experiments carried out indicate that a calcination temperature of 500°C for the oxalate followed by hydrofluorination at 500°C is optimum. It is necessary to pass oxygen gas along with hydrogen fluoride in order to prevent formation of plutonium trifluoride. Though the oxygen to hydrogen fluoride ratio in the hydrofluorination gas does not appear to be very critical, a minimum of 25–30% oxygen in the gas mixture is necessary to prevent formation of the trifluoride. Plutonium trifluoride, if formed, can be converted to the tetrafluoride by increasing the oxygen percentage in the hydrofluorination gas mixture and hydrofluorinating at the optimum temperature. X-ray analyses of the products obtained by hydrofluorination of the oxide under different conditions are also discussed.

ORGANIC CHEMISTRY

2. Synthesis of Naphthacenequinones.

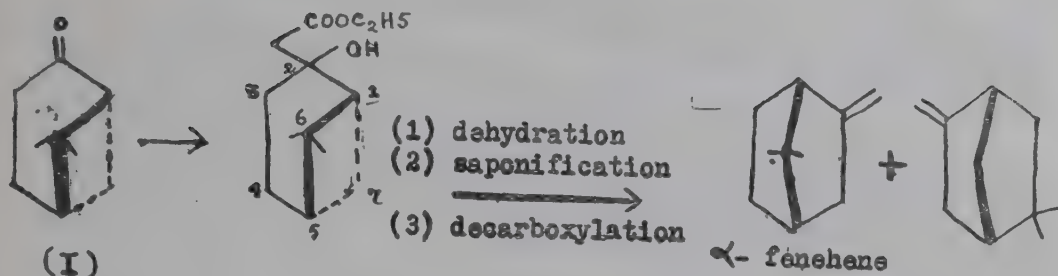
V. M. BAKSHI and A. B. KULKARNI, Bombay.

Carboxybenzylidene tetralones were found to undergo a molecular rearrangement to carboxybenzyl naphthols under the influence of methanolic sodium methoxide. Thus 3-carboxy-5-chloro-8-methoxy-2-(4-methoxybenzyl)-1-naphthol was obtained. It was cyclised to the corresponding naphthacene ketone. The methyl ether of the ketone on oxidation with chromic acid led to the synthesis of 10-chloro-2:6:7-trimethoxy-5:12-naphthacenequinone. The general applicability of the route to the synthesis of naphthacene-quinones was studied by rearranging 3-carboxy-5-methoxy-2-(4-methoxybenzylidene)-8-methyl-1-tetralone to the corresponding naphthol and oxidising a naphthacene ketone obtained on cyclisation to the quinone.

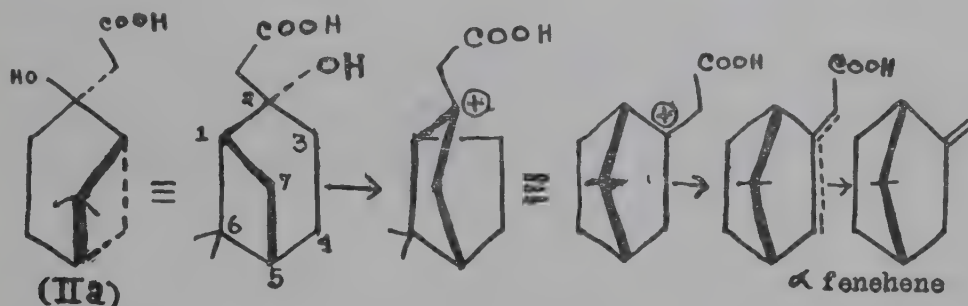
3. Stereochemistry of the Wagner-Meerwein rearrangement in the pinene series.

N. A. ABRAHAM and M. VILKAS, Paris.

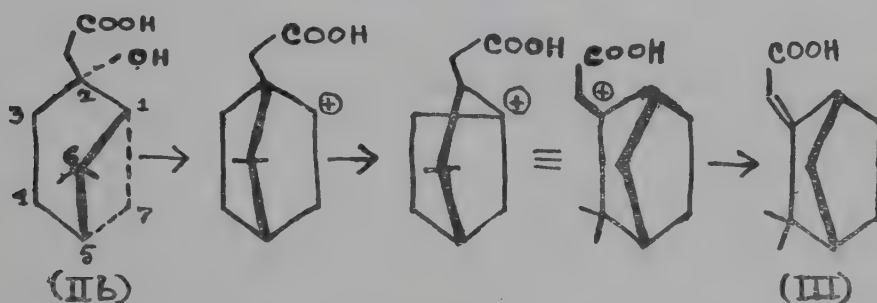
The α - and β -pinenes under the influence of strong acids usually give a mixture of monocyclic (e.g. limonene), bornylic (e.g. camphene) and fenchylic derivatives. But there exists an exception to this general rule. In 1900, Wallach showed that nopinolacetic ester (II), obtained by the Reformatsky reaction on nopinone (I), when dehydrated by potassium bisulphate and the mixture of unsaturated esters thus obtained, on saponification followed by decarboxylation by pyrolysis, gives a mixture of α - and β -fenchenes. We have explained the nature of this transposition on the basis of the configuration of carbon-2.



To verify our explanation, we have prepared the two diastereoisomers of nopinolacetic acid (IIa and IIb). The trans-acid (IIa) (OH trans with respect to methylene bridge) heated in quinoline in presence of *p*-toluene sulphonic acid, loses carbon dioxide and water giving a mixture of pinene and α -fenchene. This is formed by fenchylic transposition i.e. 1-2 shift of carbon 7.



On the other hand the cis isomer (IIb) on similar treatment gives mainly ω -camphene-carboxylic acid (III) by bornylic transposition i.e. 1-2 shift of carbon 6.



In both cases therefore, the carbon, which is trans with respect to the hydroxyl, that migrates. This is therefore in accordance with the general steric rules of Wagner-Meerwein rearrangement.

ANALYTICAL CHEMISTRY

4. Pyrohydrolytic determination of fluoride in uranium and plutonium fluorides in submilligram level.

G. S. RAO and M. S. SUBRAMANIAN, Bombay.

A simple pyrohydrolytic method for the separation and estimation of sub-milligram quantities of fluoride in uranium and plutonium fluorides has been described. The substance is heated in a current of moist oxygen or air at 800°C

$\pm 10^\circ\text{C}$ and the volatalised fluoride absorbed in dil. sodium hydroxide solution. The fluoride in the alkaline solution is determined using the Zirconium-Alizarin lake spectrophotometrically at 525 m μ .

5. Method for estimation of ferrocyanide.

G. V. L. N. MURTY and T. S. VISWANATHAN, Jamshedpur.

A method has been* described for the estimation of ferrocyanides by decomposing them to ferric hydroxide with alkaline hypobromite. The resulting ferric hydroxide is estimated by permanganate in the usual way.

6. An absorptiometric method for the estimation of microgram quantities of cyanide.

G. V L. N. MURTY and T. S. VISWANATHAN, Jamshedpur.

Cyanides in concentrations down to 0.01 p.p.m. can be accurately estimated by conversion to cyanogen bromide and subsequent reaction with pyridine and barbituric acid forming a color complex. The stability of the color developed and the sensitivity of this method are superior to those of other colorimetric methods in current use for this estimation.

BIOCHEMISTRY

7. The role of Phenolic bodies in the metabolism of Sandal (*Santalum album* Linn) in health and disease.

K. PARTHASARATHI and M. N. RAMASWAMY, Bangalore.

The important role of phenolic bodies in plant metabolism is well-known. Similar studies on Sandal (*Santalum album* Linn) have not been carried out. They were taken up as part of a many sided study of sandal spike, a plant virus disease of great economic consequence. A Colorimetric method of known margin of accuracy was employed. Results so far obtained show that quite apart from seasonal variations and variations due to the onset of flowering and fruiting stages, there does exist significant differences in health and disease. These results are discussed. The possibility of adapting such difference as a diagnostic technique is indicated.

NUCLEAR CHEMISTRY

8. Fission of thorium-232 by 'Apsara' Neutrons mass-yield curve.

H. D. SHARMA, M. V. RAMANIAH, R. HARIHARA IYER, C. K. MATHEWS, N. RAVINDRAN NAIR, K. RENGAN and D. V. SINGH, Bombay.

Fission yields of thirteen nuclides (Br-83, Sr-89, Sr-91, Mo-99, Ru-103, Ru-106, Ag-111, Pd-112, Cd-115, Ba-140, Pr-143, Nd-147 and Eu-156) have been determined for the fission of Th-232 by 'Apsara' neutrons using radiochemical techniques. The mass-yield curve has the familiar double-humped shape. The highest yield is about 8% and the lowest in the trough is about 0.05%, and the peak to trough ratio is about 160.

APPLIED CHEMISTRY

9. Dehydrogenation of Five- and Six-membered Cyclanes in the presence of Activated Carbon.

N. I. SHUIKIN and T. I. NARYSHKINA, Moscow.

Activated birchwood carbon has been found to be capable of dehydrogenating five- and six-membered cyclanes at elevated temperatures in high yields. At 600° the extent of conversion of cyclohexane and methylcyclohexane to aromatic hydrocarbons reaches a value of upto 97 and 100%, respectively. Cyclopentane and methylcyclopentane under these conditions are converted to the corresponding cyclopentadienes in yields upto 29%. The control experiments carried out without the catalyst show no noticeable dehydrogenation under these conditions. Lowering the temperature from 600° to 500° brings about a significant reduction in dehydrogenation products.

Section V, Geology & Geography

1. Scale point method of tilt and swing determination from aerial photograph.

P. B. SHANI, Roorkee.

The paper deals with a graphical method of determining the tilt of aerial photographs along with other elements of exterior orientation used in Photogrammetry. The author has given mathematical proof of the formulae used and explained the importance of the data collected for its application in preparing controlled mosaics and rectification for subsequent interpretation for various Engineering projects. The accuracy attained by the method is fully discussed along with its advantages over other analytical photogrammetric methods.

2. Sedimentary petrographic studies in Upper Siwaliks of parts of Punjab.

A. T. R. RAJU and P. V. DEHADRAI, Dehra Dun.

The study of heavy mineral assemblages of Upper Siwaliks sediments in parts of Punjab suggest two possible basins of deposition. One of these lies to the North-East of Jawalamukhi region comprising the Jawalamukhi over-thrust block, the Paror anticlinal area of Dharamsala and parts of Nurpur area. This basin may conveniently be called the Lambagroan basin in which Upper Siwaliks conglomerates and pebble beds were deposited. The south west limb of Paror anticline shows the maximum thickness of these beds (4500 ft.) which are divisible into three zones (A, B, C) based on heavy mineral assemblages. The basal zone A is characterised by flooding of rounded tourmaline and zircon with pebbles of older sediments indicating a reworked nature of these beds. The mineral suite of these beds is simple with an increase in epidote content towards the younger beds. The reworked nature of sediments at the base of Upper Siwaliks of this basin is attributed to the probable upheaval of sediments at the end of Middle Siwalik period. This upheaval may correspond to the Himalayan upheaval at the end of Pliocene represented by a break between the Dhokpathan and Tatrot. (first appearance of *Equus* according to G.E. Lewis-1937).

The second Upper Siwalik basin (conveniently called the Soan-Sutlej basin) appears to be a major one comprising the Bharwain, Janauri, Bhakra and other areas to the South-West of Jawalamukhi. There is a sudden increase in the complexity of heavy residue of these beds as compared to the suite of underlying Middle Siwaliks, indicating new sources exposed to erosion. The assemblage is marked by the presence of hornblende, sillimanite, kyanite, andalusite and sphene. Lithologically they are composed of a lower sandstone group, a middle red clay group and an upper boulder conglomerate group. The maximum observed thickness of these sediments is 6800 ft. in the Bhakra Section.

The two above mentioned Upper Siwalik basins appear to have been separated from one another by a series of N.W.-S.E. running basinal highs probably corresponding to the present day Mastagarh, Bhal and Changartalai anticlinal trends.

3. A note on the slate quarrying around Kund ($28^{\circ} 9'$: $27^{\circ} 27'$), Rewari, Punjab.

P. KUMAR, Roorkee.

Kund ($28^{\circ} 9'$: $27^{\circ} 27'$) slate quarries are the most important slate quarries in Northern India. The deposits are wholly metamorphic argillaceous and belong to the Ajabgarh series which lie at the top of the Delhi System of Purana Age. The general strike trend is NNE-SSW and the dips are always very high ranging from 60° to 80° due west.

There are a number of small quarries in this area and the only major unit is that of Kangra Valley Slate Co. Ltd. Their quarries are only semi-mechanized and use only pneumatic and electric drills. Loading and transport is done manually. Block making, splitting and dressing is also done by hand using chisels 10" to 15" long with an edge 2" to $3\frac{1}{2}$ " broad and ordinary hammers. Thickness obtained ranges between $\frac{1}{8}$ " to 4". There are two types of slate—"Superfine Kund" and "Superior Rewari". Depending upon the sizes they are known as "Dutches", "Countess" and "Lady". Common products include pent-roof slates, damp-proof slates and dressed edge slates.

The future of these quarries has been discussed in the paper. Measures required to develop these quarries have been suggested and a bright future is vouchsafed.

4. First note of the sedimentary structures from the Upper Vindhyan of Maihar-Rewah Area, Madhya Pradesh.

R. C. MISRA and KM. N. AWASTHI, Madhya Pradesh.

In a recent geological excursion the writers have discovered a number of sedimentary structures, mostly from the Upper Vindhyan of Maihar-Rewah area, falling in sheets Nos. 63D/11, 15, 16, 63H/3 of the Survey of India maps, in Madhya Pradesh.

Except for a few stages of the Semri and Kaimur series and the diamondiferous conglomerates, the entire Vindhyan sequence is represented in this area, as would be obvious from the accompanying table.

The Bhandar series consists of limestones at the bottom, Sirbu shales in the middle and the sandstones at the top. The Bhandar limestones are purplish cream coloured, grey and dark in colour. The wide variability of colour and character is a notable feature. Algal structure (stromatolites) stylolites, swashmarks, boudinage structure are common in this horizon.

Sirbu shales are made up of purple and green shales interbedded with thinly bedded sandstone. The shales are characterised by intercalations, lenticles and

pockets of red clay within dull brown matrix which gives a mottled appearance to the shales. They are ubiquitously ripple-marked; the ripple marks trend commonly in two directions normal to each other, and often crests are flattened by contemporaneous erosion. The most remarkable feature of the shales is the development of Salt-pseudomorphs, often showing depressions in the cube faces.

Pebble marks, gas-pits, worm-tracks, and swash-marks are also seen in the shales. The interbedded sandstone layers show crossbedding, and occasionally flow-casts. A greenish variant of the Sirbus exhibits small rounded and rarely egg-shaped, black discoidal bodies with tiny depression in the centre. They resemble *Fermoria* of Chapman.

The Bhandar sandstones consist of very hard, massive and compact quartzitic standstones of uniformly purplish colour, showing ripple marks.

The Rewah series comprises shales at the base and sandstones at the top. The shales are predominantly olive green, grey and dull brown in colour which contain sandy nodules disposed conformably with the bedding planes. The interbedded sandstone layers show excellent flute casts.

The Rewah standstones are highly ferruginous coarse grained and often thinly laminated. Mottling is a notable feature of the Rewah sandstones. Ripple marks and current bedding are also seen.

The Kaimurs, consists of hard, compact, medium to fine grained quartzitic sandstones, characterised by mottling. The sandstones show penecontemporaneous deformation and cross-bedding.

It may be pointed out that the similarity of the purple sandstones of the Cambrians of Salt Range (Pakistan) with these of the Vindhya has often been alluded to by many workers. The Sirbu shales of the Bhandar series bear not only the lithological identity with that of the Salt pseudomorph shales of the Cambrian of the Salt Range, but also the cube-shaped, Salt-pseudomorphs.

Section VIII, Anthropology & Archaeology

1. Finger Dermatoglyphics of the Kotas of Nilgiris.

MANISH RANJAN CHAKRAVARTTI, Ootacamund.

The Kotas, one of the four important Nilgiri tribes numbering about 1229 according to 1951 census. According to Dr. Opert, "It seems probable that the Kotas and the Todas lived near each other before the settlement of the latter on the Nilgiris". Their dialects betray a great resemblance. The Kotas inhabit seven villages in the Nilgiris. The data comprise 224 individuals (male 124; female 100). The general order of the papillary pattern shows L>W in both the sexes. The males possess 42.90% whorls as against 41.20% in the females while the loops occur in 55.00% and 54.60% respectively in the two sexes. The occurrence of arch is seen more in females (4.20%) than in the males (2.10%). A detailed genetic study of the finger-prints of the Kotas has been done.

2. Palmar Dermatoglyphics of the Todas of Nilgiris.

MANISH RANJAN CHAKRAVARTTI, Ootacamund.

The Todas, although living in a mountainous district, are a pastoral people. The Toda non-converts who number 612 live in 51 munds with two endogamous groups namely Tartharzell and Teivaloll along with 15 exogamous territorial clans. The data comprise 210 Toda non-converts (100 males and 110 females). The palmar main line formula 11.9.7— occurs as the highest frequency in both the

sexes. The formula 9.7.5— occurs as the second highest frequency in males while 11.0.7— comes second in order in the females. The percentage of occurrence of 7.5.5— is very low in both the sexes. A detailed investigation regarding the hypothenar, thenar, interdigital areas and the axial triradii has been made.

3. Finger Dermatoglyphics of the Todas of Nilgiris.

SALIL KUMAR BASU, Ootacamund.

The Todas are a pastoral, polyandrous tribe of the Nilgiris who claim themselves as the autochthons of the Blue Mountains. The total Toda population in 1960 is 879 (Non-converts 612; converts 267). A dermatoglyphic study has been done on 210 Toda non-converts (male 100; female 110). The general order of papillary patterns show $L > W$ in males and $W > L$ in females. The males possess 44.60% Whorl against 48.73% in females. The total loops are more in males (52.40%) than in females (45.45%). Arch is seen more in females than in the males. A thorough genetic study of the Toda finger-prints has been worked out.

4. Palmar Dermatoglyphics of the Kotas of Nilgiris.

SALIL KUMAR BASU, Ootacamund.

The present paper deals with a dermatoglyphic investigation on 224 Kotas (males 124; females 100). The Kotas and the Todas, the two most important tribes of the Nilgiris differ remarkably in general appearance and still more in dermatoglyphic characters from the other inhabitants of South India. For many centuries, these two tribes were isolated from the people of the plains below. These two tribes here formed a social enclave which was geographically closed to Indian life but culturally remote from it. These two tribes live here in economic and social symbiosis, the Todas being pastoral and the Kotas artisan.

The palmar main line formula 11.9.7— is highest in both the sexes. The formula 9.7.5— and 7.5.5— occur more in males than in females. The absence of line C is well marked in both sexes. An extensive study about the hypothenar, thenar, interdigital and axial triradii has been made.

5. Taste Sensitivity of Phenylthiocarbamide among the non-vegetarians, betel chewers and smokers.

PRAVEEN KUMAR SETH, Delhi.

The Taste-Sensitivity to Phenylthiocarbamide has not, as yet, been correlated with the habits of betel chewing and non-vegetarianism.

The Phenylthiocarbamide taste deficiency—as regards the eating, chewing and smoking habits—was tested among 102 Rajputs and 99 Brahmins, males by taking the age factor into consideration (9 to 35 years).

A maiden attempt has been made to test if betel chewing and non-vegetarian habits have any correlation with the ability to taste PTC. It was found that Rajputs have a fairly high incidence of tasters among the betel chewers (61.76%) as compared to the Brahmins (50.50%). It has also been found out that both the betel chewers and non-betel chewers show higher incidence of tasters as compared to non-tasters.

Both among the Rajputs and Brahmins, the non-vegetarians show more tasters (73.53% and 54.54%, respectively) than the vegetarians (14.70% and 33.33%.

respectively). This is also true for the non-tasters who are slightly more in the non-vegetarian group as compared to the vegetarian group.

An attempt has also been made like other workers, to correlate smoking habit with the tasting ability and it has been found that the non-smokers (60.78%) have more tasters than the smokers (27.45%). Similarly, the non-smokers show slightly high incidence of non-tasters (7.84%) as compared to smokers (7.92%). The frequencies given within brackets pertain to Rajputs. The Brahmins also show almost similar results.

The Chi-square tests as applied to the above data show, that betel-chewing, non-vegetarianism and smoking habits have, statistically speaking, insignificant effect on the taste sensitivity to PTC.

Thus, the habits of betel chewing and non-vegetarianism as well as that of smoking do not affect the ability to taste PTC in any respect.

6. The Nayars.

K. V. KRISHNA AYYAR, Coimbatore.

Dr. Ehrenfels' *Mother-Right in India* indicates that the mother-right in Kerala is only a survival of what was once prevalent throughout India.

On account of its geographical position Kerala could be peopled only from outside, and on account of the fierce exuberance of Nature and the difficulties of the terrain, the people who came here must have been refugees from the more habitable regions east of the Western Ghats.

Dr. Ehrenfels recognises four different strata among the mother-right peoples of Kerala: (1) the Kadirs and other jungle folk, (2) the Cherumans and the Pulayans, (3) the Parayans and (4) the Nayars. Their antiquity varies inversely with their numbers, technological equipment and status. The second and third group have long lost most of their matriarchal features while the first group is still the food gatherers of even pre-lithic age.

The Nayars alone retain the primeval matriarchal features: the authority of the oldest lady of the house, descent, inheritance and pollution through the female, freedom of marriage and divorce, polyandry and strict matrilocality (till recent times), elaborate puberty rights, and worship of the Mother-Goddess.

They appear for the first time in the inscriptions of the ninth century; the matrilineal inheritance is first referred to in literature by Sekkilar in the twelfth century only.

The Nayars cannot be identified with the Kalabhras, the Kadambas, and the Kongus who invaded Kerala between the fourth and ninth century B.C. or with the Moriyas who invaded S. India in the first century. Nor could they be traced to the Huns, the Kushans, the Pahlavas, the Parthians, the Sakas or the Greeks, as all of them were patriarchal.

The Pandyas, the Cholas, and the Ceras (Keralaputras) whose ancestors might have originally lived in the vicinity of Harappa and Mohenjo Daro (according to the interpretation of the Harappa pictographs by Fr. Heras) were also patrilineal. The Nayars cannot also be derived from the Harappans, as Dr. Ehrenfels is inclined to do, since nothing has been discovered which proves that the Harappans were matriarchal.

With no bride price and with no responsibility for the maintenance of the family, it gradually became the rule for all but the eldest son among the *Nampis* or Brahmins in Kerala to enter into *Sambandham* or free marriage unions with the matrilineal folk, thus preventing their conversion to patriliney, which took place in other parts of India. The Nayars imbibed the culture of the *Nampis* while, as parent and priest, the *Nampis* became all in all. Kerala became the *Nampi* country of the Chinese historians.

7. Anthropology in India: The needs of the day.

YOGESH ATAL, Chandigarh.

Due to recent developments in Anthropology and its growing recognition as a separate subject for study, it has become necessary to find out what is the state of Anthropology in India, what are the needs of the day. Some of the aspects which have hitherto received little attention are discussed here.

There is a need to systematize the vastly scattered data on tribal life available in monographs and journals, some of which have gone out of print. Library research to prepare comprehensive bibliography, compile "area-files" and compare societies should be encouraged. Comparative studies of Tribe-peasant relationships will be of great theoretical interest and practical utility. Restudies and researches into the neglected tribes or aspects of tribal life should also be conducted.

Anthropologists have also begun exploring villages-communities. In this field, there is a need for more base-line studies, comparative studies of villages or their institutions, and studies in directed culture change. While these studies are of help to the administrator-planner, they also cope-up with the recent trends in Anthropology.

Now that the age of general Anthropology is over, a synthesis is needed between courses of study and development in the subject.

8. Social structure of a matriarchal Pnar village.

AMALA P. SINHA, Lucknow.

The social structure of a village of the matriarchal Pnar tribe of Assam has been described in the paper. It has been endeavoured to study a village as a social unit in itself, internally differentiated, and to describe the social groups in a village context like how the lineages and families make up the village, and how the economic, political and religious organizations of the village work. A Pnar village is socially divided into Kyntoits, localities, which usually are the concentrations of a particular clan or lineage. In the village of Nartiang, where the present study was conducted and on the basis of which the paper has been written, consists of 53 exogamous clans, each of which is again sub-divided into a number of matrilineages, all sharing the common name of the clan. A matrilineage is a descent group. Women and children, married and unmarried, constitute a matrilineage. Each matrilineage has a female head who is the keeper of the ancestral house and the deities residing in it. It is her responsibility to arrange all the socio-religious ceremonies essential for the welfare of the matrilineage. On family level the mother or youngest sister is responsible for all socio-religious performances. Inheritance and descent is by the rule of ultimogeniture. The ties of matrikins, on the one hand, and marriage and paternity, on the other, are in constant conflict. Traditionally the former was dominant but economic progress of the people and culture contacts are leading the society to stronger family ties within the nuclear family. Pnar families may either be a matriarchal extended family of a limited nature or a nuclear family. Husband and father in the former type are merely night visitors, like the visiting husbands of Malabar, with practically no socio-economic or ritual significance in the nuclear family. Mother's brother is the family head. Emergence of private property of male has led to their 'emancipation', and consequently to the increasing popularity of nuclear families, where the father-husband is the head of the family, socio-economically though not ritually. Kinship terminology is of the narrow range, classificatory type exhibiting a structural principle of combination of alternate generations. Till recently the village was a self-sufficient economic unit, but

increase in the range of demands of the people and their purchasing capacity has lead to greater importance of markets in the life of an average Pnar.

9. Procreation among the Eunuchs.

AMALA P. SINHA, Lucknow.

The author has described the various kinds of eunuchs found in Lucknow. He describes eunuchs as a sex-perverted male, castrated or uncastrated, usually in female dress and behaving like and considering himself as a female. The Hindi equivalent of Eunuch is Hijra, the word Janka is also used. The socio-psychic factors working in a male's life which make him a Eunuch have been discussed. The basis of membership can be divided into three heads:—

(1) Sexual Inversion, (2) Sexual abuses, (3) Histrionics.

Section IX, Medical & Veterinary Sciences

1. Detection of the virus of rinderpest in goat and rabbit foetuses after inoculation during pregnancy.

S. K. CHAWLA and K. C. SINHA, Izatnagar.

Foetal involvement in various infectious diseases has formed a very important subject of study in recent years. This has two important bearings, viz., immunity in new born, which decides the prophylactic measures necessary to protect young ones and incidence of a large number of diseases, e.g., rubella, syphilis, John's disease, brucella infections and congenital defects due to toxoplasma. Studies on the nature of foetal involvement in rinderpest infection in pregnant goats and rabbits caused by the three types of rinderpest virus, viz. bovine, caprinised and lapinised have been carried out. It has been observed that the virus reaches the foetus from the maternal circulation and multiplies in the foetus. The virus content of spleen and liver of goat and rabbit foetuses was found quite high. The nature and behaviour of the virus isolated from foetus remained unaltered from the one with which it was infected.

2. Bioassay of freeze-dried goat adapted rinderpest virus vaccine.

K. C. SINHA and C. SEETHARAMAN, Izatnagar.

All-India scheme for eradication of rinderpest launched in 1954, envisaged vaccination of 80 per cent of the bovine population against this disease by 1965. The *prima facie* requirement for successful implementation of the programme is the availability of ample quantity of vaccine, especially goat adapted virus vaccine of proven standard. In the absence of an acceptable international reference or standard preparation, bioassay of the vaccine is based on the results of animal response test. Initially, although susceptible Himalayan Cattle were used, the authors used yearling buffalo-calves with advantage and obtained parallel results. Experiments were carried out to find if bioassay could be carried out on goats. The "infecting dose" at 50 and 100 per cent level ranged between 1:8000 to 1:40000 dilutions and same values were true for the later. No correlation could be found out between Goat ID_{50} or $_{100}$ with ID_{100} in hill cattle and buffalo-calves. Buffalo-calves can therefore be used in places where susceptible cattle are not available for bioassay of this vaccine.

3. Titre of the rinderpest virus in non-reactor goats.

K. C. SINHA and C. SEETHARAMAN, Izatnagar.

The pathogenic sign of rinderpest in goats consist primarily of hyperthermia. Elevation of body temperature 3-4°F above normal is usually regarded as a satisfactory yard stick of reaction for selection of goats for destruction for harvesting virus for production of goat adapted rinderpest virus vaccine. This had been a routine practice in all production centres. It is however observed that about 20-25 per cent of the infected goats do not show typical rise of body temperature and are rejected as non-reactors. Cilli (1853) reported multiplication off rinderpest virus in non-clinical cases in goats. The relationship between virus multiplication at cellular level and the modifications in virus propagation has attracted considerable attention and interest in recent times especially with reference to poliomyelitis, extremelia, influenza, vaccinia and herpes viruses. High temperature resulting in fall of pH level in cells, and increased glycolysis prolong vegetative phase of virus and blocks effective multiplication. These findings are true in respect of caprinised rinderpest virus also. It has been observed that active multiplication of rinderpest virus is possible in goats at 39-40°C temperature level and the titre of spleen tissue virus from such goats, apparently in non-clinical stage of disease, is significantly high. This is also an important fact for proper understanding of epizootiology of the disease and ecology of the virus.

4. Occurrence of atherosclerosis in cattle, sheep and goats in India.

P. G. PANDE, G. L. SHARMA and N. P. BHALLA,
Mukteswar-Kumaon.

Natural cases of atherosclerosis in hill cattle, sheep and goats have been recorded for the first time in India. According to available literature such cases are rare in domestic animals. Most of the cases observed were encountered during the winter season.

The intimal lesions, found in the thoracic and abdominal aorta were in the form of minute spots or occurred as circular or quadrangular greyish white brittle plaques. The latter in some cases were even a couple of inches in length. The plaques, particularly of large size, had a depressed centre and raised border.

Histopathologically the lesions were characterised by (1) the deposition of cholesterol and cholesterol esters (confirmed by Schultz method of staining) in the areas of degeneratioin noticed at the junction of tunica intima and media; (2) presence of numerous macrophages loaded with phagocytosed lipoids (foam cells) in the degenerating areas; (3) degeneration of elastic tissue fibres as evidenced by Verhoeff's method of staining; (4) focal proliferation of connective tissue cells along with the infiltration of mononuclear cells and (5) calcification in the advanced cases. In the latter the lesions extended upto the external third of the tunica media.

The possible aetiological factors believed to be involved in the causation of this disease have been discussed and further work to elucidate the aetiology of this condition have been suggested.

5. Active cellular lysis of local tissues and transformation of peripheral remaining tissues into endothelium leading to vessel formation as shown in mammary carcinoma in mice.

HEMPROVA GHOSH, Dallas, Texas.

Active cellular lysis of local tissue is found to play an important role in vessel formation. The spaces for vascular channels are created by the liquefaction

of cells and tissues including parenchyma or stromal elements. In the process the liquified cells or tissue products are added to the general circulation. The endothelium appears to originate from the remnants of peripheral tissue enclosing the newly formed vascular space. This mechanism of vessel formation was observed in different types of tissues in adult, embryonic and neoplastic conditions. It has been studied both in humans and animals (fish, mice, rats, rabbits, cats and dogs).

In the process of liquifaction there may not be any previously associated histological changes in the tissues as in the case of *in vitro*, digestion of tissue by proteolytic enzymes. This type of liquifaction by digestion appears to be the fastest and most common occurrence in the formation of fluid inside the vessels. Sometimes intermediate changes are seen, which include different types of degeneration and necrosis. It has also been demonstrated how easily a frequent of unlysed tumour tissue lying in the course of vessel formation may act as the source of metastasis in a tumour.

6. Some aspects of chronic manganese poisoning in Madhya Pradesh.

S. L. GOSWAMI, T. P. NIYOGI, S. R. TELANG and R. K. GUPTA,
Jabalpur.

On account of increasing importance in Manganese mining in Madhya Pradesh and India, it was considered expeditious to undertake a detailed study about the various aspects of Chronic Manganese Poisoning Syndrome (Manganism).

About 87 labourers employed at Gwari Wadhona Manganese mines, District Chhindwara (M.P.) belonging to different categories were clinically surveyed. These cases could be classified clinically according to their manifestations of the disease as follows :—

Classification :—

1. Respiratory complications ...	...	...	53/87—60.9% incidence
2. Neurological Syndrome ...	...	...	24/87—27 % „
3. Manganese Pneumopathy ...	...	...	1/87—1.14% „

The broad-spectrum symptomatology of neurological syndrome seems to converge on two main targets :—

- (i) Behavioural and personality changes.
- (ii) Extrapyramidal involvement.

The experimental studies on animals and laboratory investigations on the following cases were undertaken :—

1. Human controls.
2. Labourers exposed to manganese dust in the mines.
3. Clinically positive cases discharged as invalids.

A. Experimental Studies :—

The experimental studies on animals, rats and guinea pigs when exposed to manganese dust showed that the urinary excretion of manganese could serve as a sensitive parameter for the metabolic studies of the metal in the body, although the major channel of excretion being the faeces. Further that the biological material from such animals could possibly serve complementary to human material in studying the pathogenesis of the disease.

B. Pharmacodynamic Studies :—

1. Manganese chloride in doses of 1 to 6 mgm./kgm. body weight at normal pH produced a sharp fall in carotid blood pressure in an anaesthetized dog returning to normal within 5 minutes. This action was not antagonized by atropine and mepyremine maleate etc.

2. Manganese chloride in the same doses on heart in situ in dogs showed depression in the amplitude and rate of auricular and ventricular contraction.

3. 3 hour slow intracarotid perfusion of dog's brain with 20 mgm./kgm. doses showed a fall in choline-esterase activity in the blood samples collected through jugular vein.

C. Human Studies :—

1. *Control cases* :—24 hour urine of 50 male adults of an average age varying from 25 to 45 years were estimated for their Manganese content (Mehlig J. P. 1941). The average normal showed about 35.5 ± 12 microgm./1000 c.c.

2. *Labourers exposed to manganese dust inhalation at Gwari Wadhona Mines* :—Manganese excretion in 24 hour urine of 36 labourers belonging to three categories—Drillman, Machineman and Loader—Timberman showed on an average about 210 microgm./1000 c.c., the drillman however showing the highest. The Manganese excretion was not related to the duration of exposure but to the abnormally high concentration of manganese dust in the underground atmosphere.

3. *Five clinically positive invalid cases of Chronic Manganese Poisoning* :—On an average these cases showed about 140 microgm./1000 c.c. of Manganese in urine, although these cases had been withdrawn from the mines for a period of 4 to 5 years.

4. *Periodic excretion of Manganese for a period of 24 hours in a positive Manganese poisoning case* :—Six hours sample of urine was estimated for Manganese content for 10 estimations each. A semi-logarithmic representation of the average indicated a uniform excretion of Manganese per unit time.

5. 5-Hydroxy-Indole-Acetic Acid estimation in 24 hours urine of five clinically positive cases by the method of (Salkowsky 1938) showed increased urinary excretion of 5-HIAA than the normal range, probably indicating excessive 5-H.T. metabolism.

7. Studies on Mastitis. III. Etiology of mastitis.

M. S. SETHI and M. R. DHANDA, Mukteswar-Kumaun.

A survey of nine large dairy herds, located in the different parts of the country was undertaken with a view to ascertain the causal agents responsible for mastitis. It was revealed that *Staph. aureus* and various species of streptococci were responsible for about 98 per cent of the total number of infected cases; the remaining about 2 per cent being due to *C. pyogenes*, *Pseudomonas pyocyaneae* and yeasts. *Staph. aureus* was found responsible for the largest number of cases (41.2 per cent in cows and 30.5 per cent in buffaloes). Streptococci were next in order of distribution. The figures for cows and buffaloes were, *Str. agalactiae* 15.0 per cent and 7.9 per cent, *Str. dysgalactiae* 14.5 per cent and 11.3 per cent, *Str. uberis* 6.7 per cent and 17.2 per cent, *St. pyogenes* 0.5 per cent and 4.0 per cent, *Str. zooepidemicus* 0.2 per cent and 4.6 per cent, *Str. equisimilis* 1.0 per cent and 10.6 per cent and streptococcus group G 0.5 per cent and nil respectively. In addition mixed infections which were recorded as 19.3 per cent in cows and 4.0 per

cent in buffaloes were also due to *Staph. aureus* and the streptococcal species enumerated above. Organisms of doubtful pathogenicity e.g. *Aerobacter aerogenes*, *E. scherichis coli*, non-haemolytic diphtheroids and coagulase negative staphylococci were also isolated.

The methods of collection of the material and the procedure adopted for the isolation of the organisms have been described. Various criteria such as morphology, staining characters, haemolysis, cultural characters, biochemical reactions and serological tests employed for the study of the aetiological agents have been given and their significance, in the typing of cultures has been discussed.

Work, in respect of the aetiology of mastitis, undertaken in some of the western countries as well as in India, has been reviewed.

8. Studies on Mastitis. IV. Treatment of Mastitis.

M. S. SETHI and M. R. DHANDA, Mukteswar-Kumaun,

In this study the drugs employed for trial treatment were, procaine penicillin G, penicillin G, dihydrostreptomycin, sulphamezathine, terramycin, chloramphenicol, nitrofurazone, "Udolac", "Vetiox" and Chaulmoogryl pyridinum bromide which were tried against mastitis due to *Str. agalactiae*, *Staph. aureus*, mixed infection of these two organisms, *Str. dysgalactiae* and *Corynebacterium pyogenes*.

Penicillin was found effective in curing 85 per cent of mastitis cases due to *Str. agalactiae* and the antibiotic was more efficacious in aqueous solution than when administered in wax. The percentage cure of mastitis cases due to *Staph. aureus* infection was 75.0 when treatment with a mixture of penicillin, dihydrostreptomycin, and cobalt sulphate was carried out. Infection due to *Str. dysgalactiae* and early cases of mastitis due to *C. pyogenes* were successfully treated with a combination of these drugs.

The technique employed in infusing the drug into the udder has been improved from the one hitherto adopted. On the basis of trials on a limited number of cases, it has been observed that "Vetiox", "Udolac" orally and intramammarily, nitrofurazone, terramycin paste and chloramphenicol ointment were not found to be efficacious. Moreover, most of these drugs were found irritant for the udder tissue. Deviation in the milking routine during the course of treatment, when the drug was allowed to remain the udder for 24 hours at a stretch, had a deleterious effect on the average milk yield of heavy milkers.

9. Studies on Mastitis. V. What Mastitis in dairy animals costs to India.

P. G. PANDE, M. S. SETHI and M. R. DHANDA, Mukteswar-Kumaon.

As a result of survey of various dairy herds located in the different parts of the country it was revealed that due to Mastitis 7.2 per cent of the cows and 7.8 per cent of the buffaloes lost at least one of their teats. Further, it was observed that 3.9 cent of the cows and 2.3 per cent of the buffaloes were advanced clinical cases, the milk from which was unfit for human consumption and had to be discarded. Based on these two factors the annual financial loss, to the country has been worked out to approximately 52.9 crores of rupees. The importance of mastitis from the public health point of view has also been brought out. Measures to prevent losses due to the disease have been suggested.

10. Salmonellosis in Guinea-Pigs.

M. S. SETHI and M. R. DHANDA, Mukteswar-Kumaon.

Two outbreaks of salmonellosis, in two guinea-pigs colonies, each due to a different species, viz. *S. anatum* and *S. typhimurium*, have been reported. The outbreaks were noticed more or less simultaneously. The causal agents being different, the symptoms observed in one were different from the other.

The organisms isolated were typed on the basis of their biochemical characters as well as serological reaction.

A treatment-trial, to judge the efficacy of sulphamezathine by oral administration, was found promising.

Vaccination with autovaccines prepared from each strain gave encouraging results.

Efforts were made to ascertain the source of infection in these colonies although these were of no avail. A few possible sources of infection have been discussed.

11. Studies on the Viability of Contagious Caprine Pleuro Pneumonia Organism—I. Viability of the organism in infected tissues and on sterile earth and filter paper trips.

G. L. SHARMA and N. P. BHALLA, Mukteswar-Kumaon.

Viability of the organism in the tissues, collected from experimentally infected goats, immediately after death, was studied as information regarding the suitable conditions for the despatch of material from natural cases of the disease was much needed. The material stored at 37°C, room temperature, and $\pm 5^\circ\text{C}$ in sterilized phosphate buffered glycerine saline, p.H. 7.0, was tested in goats at different intervals. In two such trials, it was found that the organism remained viable for 15 to 32, 32 to 65 and 74 to 135 days at 37°C, room temperature, and $\pm 5^\circ\text{C}$ respectively.

Viability of the organism was also studied on inanimate objects (sterile earth and filter paper strips) with a view to see as to how long the premises in which the natural cases of the disease were kept, could remain infective for the healthy stock. Two different lots of test tubes, one containing earth and the other containing filter paper strips were sterilized and a uniform quantity of a virulent serum broth culture of contagious caprine pleuro pneumonia organism inoculated into the tubes which were stored at 37°C, room temperature and $\pm 5^\circ\text{C}$. The viability of the organism was tested at different intervals by adding serumised broth (p.H. 7.4) into three tubes from each lot and the growth if obtained was tested for purity. Results of the three trials showed that on filter paper strips, the organism was viable for 2 to 3, 9 to 17 and upto 257 days at 37°C, room temperature and $\pm 5^\circ\text{C}$ respectively. The viability on earth was for 1 to 2; 3 to 21 and 11 to 120 days at 37°C, room temperature and $\pm 5^\circ\text{C}$ respectively. The possible factors responsible for the wide range in the viability have been discussed.

12. Studies on the development of Avianised Contagious Caprine Pleuro-Pneumonia Vaccine—I. Adaptation of virulent Contagious Caprine Pleuro-pneumonia organism to grow in developing chick embryo and its influence on the virulence of the organism.

G. L. SHARMA, N. P. BHALLA and M. S. NAGI, Mukteswar-Kumaon.

Studies were undertaken to develop an avianised contagious caprine pleuro-pneumonia vaccine with a view to improve upon the Attended Culture Vaccine

recently evolved at this Institute. Virulent strain of contagious caprine pleuropneumonia could be successfully adapted to grow in the developing chick embryo in which the macroscopic changes produced were characterised by marked oedema of the Chorio-allantoic membrane, ecchymotic haemorrhages over the head, neck and legs. The strain had undergone 154 serial passages in the chick embryo of which the first 100 passages were by chorio-allantoic method of inoculation and the last 57 passages were through the yolk sac. The egg adapted strain was tested for its virulence in susceptible goats at 10, 25, 40, 61, 77, 137 and 154 passage levels but there was no indication of the strain getting attenuated as the goats inoculated with the strain reacted severely and died of the disease. The organism was invariably isolated from the heart blood of the goats. The results have been discussed with those reported by other workers.

13. Studies on the *in-vivo* effect of Terramycin and Dihydrostreptomycin on the Organism of Contagious Caprine Pleuro-pneumonia (*Mycoplasma Mycoides*-Var. Capri).

G. L. SHARMA and N. P. BHALLA, Mukteswar-Kumaon.

In-vivo chemotherapeutic effect of terramycin (Veterinary formula) on *Mycoplasma mycoides* var capri was preceded by the *in-vitro* studies, which showed that the antibiotic was lethal for the organism at the concentration of 50 μ gm. per ml. of serumised broth.

Twentyfour goats were experimentally infected with the virulent cultures of *M. mycoides*-var. capri and 21 of those were put under terramycin treatment at 0, 6, 12, 24, 48, 60 and 72 hour intervals after infection, in batches of three. Each animal received four doses of the drug at 24 hour interval at the rate of 100—125 mgm. per inoculation. With the exception of one goat from 24 hour batch, which died of endocarditis 26 days after infection, rest of the 20 animals were successfully treated.

To find out the *in-vivo* effect of dihydrostreptomycin on the organism, 18 goats were artificially infected with contagious caprine pleuropneumonia organism, out of which only 15 were treated on lines similar to those of terramycin treatment. Post-infection intervals of treatment were 6, 12, 24, 48 and 72 hours, the dose of the antibiotic being 0.5 gms. per inoculation. One goat from 6 hours and 2 from twelve hour batch survived while the remaining animals reacted severely and died of contagious caprine pleuropneumonia.

The above finding showed that dihydrostreptomycin was not a satisfactory chemotherapeutic agent against contagious caprine pleuropneumonia, whereas, terramycin (Veterinary formula) gave very encouraging results and is therefore recommended for the treatment of naturally infected cases.

The goats which were saved with antibiotic treatment later on proved to be immune on challenge with virulent cultures of *Mycoplasma mycoides*-var. capri even after 10 months of treatment.

14. General Anaesthesia in buffaloes by intravenous use of Chloral-thiopentone Sodium Mixture.

M. P. JOHARI and S. P. SHARMA, Mathura.

A technique of general anaesthesia in water buffaloes using chloral hydras (30 Gm.), mag sulph (15 Gm.) and thiopentone sodium (2.5 Gm.) mixture (dis-

tilled water 1000 c.c.) intravenously has been described. As the Veterinarians in most cases have to work single handed, the chief consideration has been safety and effectiveness. The details of the technique, the different stages of anaesthesia, duration, toxicity of the mixture have been reported. Some minor but effective improvement in giving intravenous injection has been suggested which, if adopted, would prove useful. Nembutal (Abbott Labs.), Gerdenal sodium (May & Baker) give equally good results. The anaesthesia due to Nembutal is longer and can be produced with less of the drug. The "anaesthetic solution" with these barbiturates is clear and there are no floccules.

Section X, Agricultural Sciences

1. Effect of Gibberellic Acid on two Forage Plants—*Sorghum sudanense* and *Trifolium alexandrianum*.

SUDHIR KUMAR, Jobner.

Two forage plants *Sorghum sudanense* and *Trifolium alexandrianum* were sprayed with 3 different concentrations of Gibberellic Acid. The concentrations were 50 ppm, 100 ppm and 200 ppm.

The treated plants showed increased height and internode size. The leaves were narrower and longer in both cases. The treated plants yielded more than the control. In *Sorghum sudanense* the yield increased with increased concentration of G.A. but in *Trifolium alexandrianum* there was reduction in yield in plants treated with 200 ppm as compared to 100 ppm. The root and shoot ratio increased with increased concentration of G.A. and at 200 ppm the roots were poorly developed. The most economical concentration in both the cases was 100 ppm.

The positive results of increased yield by G.A. spraying are not without encouragement but their usefulness will depend on the cost of G.A.

2. Influence of Electrolytes on the aggregating effects of synthetic soil conditioners.

TRILOKI NATH and B. R. NAGAR, Calcutta.

The influence of electrolytes on the interaction of polymeric electrolytes with soils have been studied. Electrolytes viz : NaOH, Na₂SO₄, NaCl, H₂SO₄, HCl, CaSO₄, CaCl₂, Ca(OH)₂, Al(OH)₃, AlCl₃ and Al₂(SO₄)₃ were added along with polyelectrolytes, at two concentrations. In general the electrolytes have unfavourable influence on the aggregating effects of synthetic polyelectrolytes. Moreover on increasing the concentration of electrolytes soil aggregation by polyelectrolytes is decreased. These changes do not correspond to the changes in Zeta potential of soils, on the other hand these changes are in fair agreement with the effect of these electrolytes on Viscosity, which is related to the coiling of polyelectrolyte chains due to the addition of electrolytes. Besides, cations present on clay mineral have no bearing on the influence of electrolytes on the aggregating effectiveness of synthetic polyelectrolytes.

3. Studies on the moisture content of soil.

B. G. DABRAL, Dehra Dun.

One of the important factors determining the microclimate of a forest stand is the moisture content of the soil especially at the surface layer, thereby affecting

the humidity conditions and the cooling behaviour of a forest species. The continuous addition of organic matter on a forest floor in the shape of leaf fall ameliorates conditions for increased absorption of water and helps towards increased infiltration capacity of soil layers. In a study conducted in pine and teak plantations in F.R.I. Reserve Forest it was observed that the moisture content of surface soil in teak was invariably greater than in pine. It was least under open conditions. However it may be mentioned that on a few occasions, moisture content under pine became nearly equal to teak and even exceed it. This may either be due to increased quantity of water brought upon the surface as stem-flow or due to greater retardation of soil evaporation losses in teak or due to both. Pine litter has little moisture retaining capacity. It was observed that the amount of water held by pine litter increased with prolonged rains.

4. Soil Survey of Bundi District in Rajasthan State.

V. C. SHARMA and K. M. MEHTA, Udaipur.

Soil survey of 2000 sq. mile area of Bundi district in south-east of Rajasthan state was carried out. Survey of India topo sheet of scale 1" to a mile were used as base maps. The climate is semi arid with moderate to severe summer and severe winter. The rainfall is about 28". The soils of the district fall into two major physiographic regions—the hill region and plain region—with scattered out crops and undulating areas. The soils have been divided into thirteen different series. The series has several types and eroded phase and calcareous variant. Morphological, physical and chemical characteristics of five major series in the area have been described. Soil maps have been prepared. This classification will help in planning simple experiments on cultivator's fields with a view to have better and intensive use of varieties, fertilisers and other cropping practices for different soil types.

5. Chemical study of the changes in composition of Arecanut with maturity and processing.

A. G. MATHEW and V. S. GOVINDARAJAN, Delhi.

The kernels of arecanut at three stages of maturity, tender green mature and ripe have been analysed for the principal constituents: total water extractives, 'Tannins', fat, crude fibre, ash, total hydrolysable polysaccharides and alkaloids. The changes in the constituents with maturity are analysed as percentage of dry matter and as total amount per nut. The changes in the constituents in relation to the quality of the final product is discussed.

Similar analysis and changes during processing of the arecanut for converting into the market varieties are also discussed.

6. Bait composition and rodenticidal activity of BaCO_3 .

M. K. KRISHNAKUMARI, K. KRISHNAMURTHY and S. K. MAJUMDER,
Mysore.

Standard bait compositions for incorporation of BaCO_3 in the rodenticidal preparations are not available. Various bait compositions used by Chitre and Kunhardt and other workers contained 15-20% of BaCO_3 . Schwartz recommended

BaCO₃ at 25% level in the bait recognising its low toxicity to rats. In preliminary studies at this laboratory on the toxicity of BaCO₃ to wild rats (*Rattus rattus*) it was observed that bait composition had a great role on the BaCO₃ toxicity to the test animals. In a series of experiments, it was observed that the mortality in rats could be produced with BaCO₃ at levels of 300-750 mg. per kilogramme body weight. The bait compositions based on casein, egg albumin, groundnut protein, groundnut meal, Bengal gram, wheat, wheat gluten, rice, tapioca starch, corn starch and their combinations to give various levels of protein ranging from 0 to 50% were studied for their acceptability, intake and BaCO₃ toxicity to Albino rats and *Rattus rattus*. The *in vitro* trials and *in vivo* experiments showed that the absorption of barium from gut was inhibited in presence of high protein in the diet. The materials having low protein contents had relatively higher susceptibility coefficients for poisoning. The death time was proportionately increased with higher protein concentrations in the bait. It was observed that the acceptability of the bait and BaCO₃ toxicity were satisfactory for practical rodent control at 10% protein level.

7. Utility Gobar-gas Plant for village homes.

L. R. DHINGRA and G. S. SIDHU, Ludhiana.

Cattle dung is the most valuable source of organic manure suitable for all kinds of agricultural crops. But unfortunately about 50% of dung collected from cattle droppings is used for burning as fuel and thus loses most of its manurial value. In order to minimise this loss and at the same time to meet the fuel requirements of cultivators in villages, cowdung gas plants have been devised. Gas is produced in these by anaerobic fermentation by methane producing bacteria from dung. This gas when burnt gives a very hot flame and at the same time there is no loss of manurial ingredients from the material left out.

With a view to investigate the possibility of devising a simple, cheap and efficient plant for the production of gas from cattle dung, recently some trials have been carried out in the Biochemistry Laboratory, Government Agricultural College, Ludhiana, and very useful observations have been made. Data have been collected concerning the production of gas under conditions and temperature prevailing in the Punjab State and its proper and efficient utilization for cooking and lighting purposes.

Detailed description and pre-requisites of such gas plant, suitable for village homes has been given. A cheap and simple yet very effective type of kitchen burner has also been described.

In short it is contended that cowdung gas plant will provide the most suitable solution to the problems of fuel and good quality organic manure in the villages of the State.

8. Freeze-drying of Passion Fruit Juice (*Passiflora edulis*, Sims).

J. S. PRUTHI, Mysore.

The results of a study on the freeze-drying of Passion Fruit Juice (*Passiflora edulis*, Sims.) and the effects of in-package desiccation, vacuumization and storage temperature on moisture, vitamin C, carotene, colour, texture, flavour, reconstitution and acceptability of the juice reconstituted from the freeze-dried P.F. powder have been reported and discussed.

There were negligible losses in the important nutrients of the juice during freeze-drying. P.F. powder thus prepared had fairly high ascorbic acid content (168 mg./100 g.). The moisture content ranged from 1.1 to 2.0%. The flavour of the reconstituted juice had slightly less aroma than the fresh juice.

The overall quality of the product during storage was, to a great extent, a function of storage temperature and initial moisture content. Ascorbic acid retention was better in vacuum packed samples. In general, the product retained its quality very well when it was vacuum packed with in-package desiccant and stored at low temperature (5°C).

9. Varietal differences in the Physico-chemical characteristics of Indian Apples.

J. S. PRUTHI, C. M. PAREKH and GIRDHARI LAL, Mysore.

A fairly detailed report on the variations in the physico-chemical characteristics of 10 varieties of apples grown in Kashmir has been presented and discussed. The ten varieties studied are *Lal Ambri*, *Golden Delicious*, *Red Delicious*, *Lal Turesh*, *Lal Turesh Nawabi*, *Tarial Kesri*, *Rajai Kashmiri*, *France Kashmiri*, *Red Pippin* and *Yellow Pippin*. The relative desert quality, fruit weight, size and appearance etc. have been briefly discussed. The chemical aspects covered are total solids, acidity, sugars (total and reducing), sugar/acid ratio, astringency, pectin, protein, crude fibre, ascorbic acid, ash, Ca, P and Fe.

Sugars constituted the major portion of the total carbohydrates and reducing sugars alone comprised 70-90% of the total sugar make-up. The acidity ranged from 0.47 to 0.73% W/W as malic acid. There was no significant difference in different varieties in respect of total astringency. All varieties were rich in pectin (3.35 to 3.73% on fresh weight basis) but poor in ascorbic acid (5.84 to 9.89 mg/100 g), protein (0.06 to 0.30%) and iron, (0.48 to 1.35 mg.%).

10. Role of Mandarin Oil in the development of off-flavour in Orange Squash.

C. M. PAREKH, J. S. PRUTHI and GIRDHARI LAL, Mysore.

Systematic studies on the role of mandarin oil and several other factors in the development of off-flavour in mandarin orange squash have been made. The results indicate that the deterioration in the flavour of orange squashes is mainly due to the oxidation of volatile oil. Lipid oxidation contributes very little towards off-flavour. Heating or pasteurization causes maximum deterioration in flavour as a results of the oxidation of limonene. Contamination of metals such as iron, enhances the oxidation of both the volatile oil and the lipid fraction. However, the volatile oil is more prone to oxidation than lipid fraction. Use of antioxidants such as NDGA not only extend the shelf-life of Mandarin oil, but also show a carry-through property when oils containing NDGA are incorporated into the squashes. The use of antioxidants, generally recommended for controlling lipid oxidation, failed to control the oxidation of volatile oil. Likewise, the addition of pectin, increasing sugar concentration or raising pH of the beverage did not materially help in controlling the off-flavour.

Systematic studies on Infra-red Spectroscopy further revealed the following :

1. Off-flavour or terpany mandarin oil recovered from squashes contains substances absorbing in the hydroxyl, carbonyl and phynyl regions of the infra-red spectrum,

2. The absorption in the hydroxyl and the carbonyl regions, is probably due mainly to dl-Carvone and dl-Carveol which are the breakdown products from the oxidation of d-limonene.
3. The presence of dl-carvone and dl-carveol in deteriorated oil is responsible for the so-called "terpeny odour".

11. Effect of Desiccation, Deacidification, Demineralization and Gas Packaging in different types of containers on the physico-chemical characteristics and shelf-life of Indian Mandarin Oil.

C. M. PAREKH, J. S. PRUTHI, N. L. JAIN, G. L. TANDON and
GIRDHARI LAL, Mysore.

Based on systematic studies on the keeping quality of Indian (Nagpur) mandarin oil as affected by the various deteriorative agencies namely moisture, air or oxygen, light, temperature and metals etc., the protective role played by the various chemicals like desiccants, alkalies and ion-exchange resins for deacidification and demineralization and the effects of packaging of the oil in five different types of containers have been reported. The following best conditions of packaging and storage of Indian Mandarin oil have been standardized :

- (i) Of the three desiccants studied, treatment of oil with anhydrous Na_2SO_4 gave the best results.
- (ii) For deacidification of mandarin oil, use of NaHCO_3 was found to be superior to that of NaOH in enhancing the shelf-life of mandarin oil.
- (iii) Of the three cation exchangers studied, Deacidite E was found to be the best for the deacidification of mandarin oil. However, from economic viewpoint, the use of NaHCO_3 is preferable to Deacidite E.
- (iv) Of the five different types of containers studied, aluminium bottles were found to be the best for the efficient packaging and storage of mandarin oils as judged by their peroxide value, flavour and colour retention.
- (v) Of the three anion exchange resins studied for the demineralization of mandarin oil, Zeo-Karb 226 proved to be the most efficient. Demineralization of oil significantly enhanced the shelf-life of Indian Mandarin Oil.
- (vi) While studying inert gas packaging of mandarin oil, packaging of oil under N_2 was the best, the next being CO_2 packaging.

12. Effect of Methyl Bromide and Ethylene Dibromide Fumigation on different components of oil seeds.

K. S. SRINIVASAN, M. MUTHU and S. K. MAJUMDER, Mysore.

A comparative study of the residues of ethylene dibromide and methyl bromide on oil bearing materials like groundnut, cashewnut and copra was studied. The total bromide residues were estimated in cuticled and decuticled groundnut seeds fumigated with ethylenedibromide and methyl bromide at 3 lbs./1000 c.ft. dosage for 72 hours. The total bromide residues were 14 ppm. and 26.6 ppm. for ethylene dibromide and methyl bromide respectively. In general the organoleptic quality was satisfactory and the residues were within permissible limits in both the cases. In a further experiment, the relationship of methyl bromide and ethylene dibromide

residues to different components of cashew, groundnut and copra, whole materials, defatted cakes and their oils was studied. It was observed that ethylene dibromide was absorbed more by the oils, while the methyl bromide residues were more related to the protein components of these materials.

13. The free Amino Acids of some fresh water fishes.

A. SREENIVASAN and MRS. FREDA CHANDRASEKARAN, Bhavanisagar.

Free amino acids of the skeletal muscle fifteen fresh water fishes have been determined by the paper chromatographic method. No clear cut taxonomic differentiation of species could be made on the basis of the free amino acids. All these fishes contained alanine, glutamic acid, aspartic acid, taurine, histidine and lysine. Very few fishes, for e.g., *Anguilla*, *Macrones cor*, and *wallago* contained cystine. Proline was present in the above three carnivores and also in *Labeo Kontius*. Variations due to age and size are under study.

14. Proper time of harvesting for Maximising yield of Stick Lac.

C. P. MALHOTRA and S. KRISHNASWAMI, Namkum.

In hot areas, like Kundri in the Palamau district of Bihar, where the problem of brood survival during summer could be solved to a large extent, the yield of stick lac was reported to be poor.

Experiments were undertaken on four sets of trees, one each harvested in April and May as immature (ari), and two in June-July (at crop maturity).

Results obtained during four years show the yield of stick lac to be highest when harvested in April, slightly less when harvested in May, but considerably reduced (by ca 43.1%) when harvested in July. This is contrary to expectations and not easily explainable.

On subsequent processing and chemical analysis of seedlac and shellac from sticklac produced in all the cases, no appreciable difference in quantity and quality could be found.

Hence it is concluded that in hot areas like Kundri, from the point of view of yield of sticklac, harvesting may be encouraged in April.

15. *Psalis pennatula* F. (Lepidoptera, Lymantridae)—A new pest of cereals in Orissa.

G. C. SENGUPTA, Bhubaneswar and B. K. BEHURA, Cuttack.

The yellow hairy caterpillar, *Psalis pennatula* F. occurs as a pest on paddy (*Oryza sativa*), maize (*Zea mays*), ragi (*Eleusine coracana*) and grasses. The life-history of the moth on paddy has been studied. The eggs are spherical, faint yellow and are generally laid in clusters. The eggs hatch after 4-5 days. The newly hatched larva measure 2 mm. × 1 mm. It is blackish grey in colour with grey hairs all over the body. The head capsule is shiny black. A full-grown larva is yellowish-grey with yellow and black spots and tufts of white hair. The larval period lasts 4-5 weeks. The cocoon is of faint yellow silken threads. The pupal stage lasts 5-6 days. The adult moths are stout and have straw-coloured upper wings. Pairing takes place 2-3 days after emergence from the cocoon. The life-cycle takes 40-50 days. The female moth lays 70 to 80 eggs. There is only one generation during July to September. The pest has so far been reported from the districts of Cuttack and Puri in Orissa.

16. Bhendi leaf stalk miner.

D. B. REDDY, New Delhi.

Leaf stalks of Red wonder variety of Bhendi were found attacked by white robust larvae. These bore into the leaf stalks resulting in the death of the leaves. The maximum damage noticed was 40%. The tunnels are made in the pith of the leaf stalk and measure 1-9 cms. long.

Dark shining adults emerge breaking through the epidermal layer. The fly is identified as *Melanagromyza* sp. This is the first record of an agromyzid from leaf stalk of Bhendi from the former Hyderabad State.

17. Bean fly, a serious pest of French beans.

D. B. REDDY, New Delhi.

The slender shining white maggots cause drooping and wilting of French bean plants. The attacked portions swell and the epidermis becomes loose. Pupation occurs in the larval tunnels.

The stems at or below the ground level are severely attacked, however, the joints of branches and the axils of plants are also infested. If about 6 maggots mine into a stem, the young plants can be killed out right.

Adult is a shining black fly, 2 mm. long, halteres black and arista comparatively long. Larva slender shining white, 4 mm. long. Mandibles short and compact. Puparia cylindrical, shining yellow; 2.5 mm. long. A chalcid parasite was reared out.

This pest is reported on other crops from various parts of the world. As per the information available, this is the first record from the former Hyderabad State.

Sprays with fish oil Rosin soap at the rate of 1 lb. per gallon; 0.03% Nicotine Sulphate, 0.16% DDT, 0.03% Folidol and 0.02% Lindane, at weekly intervals showed that Nicotine Sulphate and DDT were effective in reducing the infestation

18. Agromyzid pest of Bajra, *Pennisetum typhoideum*.

D. B. REDDY, New Delhi.

Bajra, *Pennisetum typhoideum* leaves are mined by robust light greenish white maggots of *Melanagromyza* sp. Maggots mine in between the epidermal layers and sometimes the tunnels are about 30 cms. long. In young plants, mined leaves, when fresh, appear light green, but later on turn brown and white and drop off the plant.

Usually more than one maggot is found per tunnel, however, the maggots are occasionally found to be solitary miners. In one case 7 maggots were found in one leaf and usually 2-4 miners are encountered per tunnel.

Maggots work side by side and on maturity come out of tunnel for pupation. The life stages are described. This is the first record of an agromyzid fly from bajra.

19. Chirke—A new virus disease of large Cardamom (*Amomum subulatum* Roxb.)

S. P. RAYCHAUDHURI and S. N. CHATTERJEE, Kalimpong.

In surveys carried out since 1956, it has been observed that the larger cardamom in Darjeeling district is affected by a virus disease locally known as the "Chirke" disease. The disease has also been recently observed in Sikkim. The disease, unlike the 'Katte' on small cardamom and 'Foorkey' on larger cardamom, produces mosaic streaks on affected leaves which coalasce, turn brownish and dry up causing withering of the leaves. The inflorescence of the diseased plant is also affected and the number of flowers is considerably reduced. The disease is transmissible by mechanical means and the insect vector has been found to be the corn aphid, *Rhopalosiphum maidis* (Fitch) occurring commonly on maize plants. *Amomum aromaticum* (a wild species of larger cardamom) has also been found to be susceptible to the virus.

The causal virus has a thermal-death-point of 50-60°C, dilution-end-point between 1:1000 and 1:5000 and longevity *in vitro* 4-8 days at room temperature (4-33°C).

20. Two cases of Discolouration of Squid.

A. SREENIVASAN, Bhavanisagar.

The squid, *Omnaastrephes Sloenii pacificus* forms a high percentage in the fish catches of Japan. Its preservation is therefore of importance. In one case the squid treated with O T C (terramycin) and stored at ice-temperature was found to develop a yellow discolouration. This was traced to a bacterium resembling *Pseudomonas putida*. This culture tolerated a concentration of 100 p.p.m. of O T C. This was a psychrophilic organism reducing trimethylamine oxide. The second instance of discolouration was caused by a species of *Serratia*, but this occurred at temperature above 25°C, the squid turning red by the growth of this organism. But this failed to occur at 4°C and the bacterium itself failed to grow at this temperature. This culture tolerated 400 p.p.m. of O T C. Tolerance of such high concentration of the antibiotic is interesting.

21. Study of organo-mercurial Seed Treatment on the Incidence of Seedling Blight and Helminthosporium disease of Rice in West Bengal.

G. N. DAS, and S. P. SEN GUPTA, Calcutta.

Seeds (Patnai-23 strain) sown after seed-dressing treatment with Agrosan GN and Hexasan showed that both the seed-dressings gave higher percentage of germination and tillering over the untreated control. The beneficial effect, however, was found to vary at the four localities where tests were carried out.

The effect of the two seed-dressings was found to be statistically significant in reducing the leaf infection value at 1% level at 3 localities and at 5% level at the fourth. However, the grain yield in one of the localities only was found to be significantly higher with the two seed-dressing fungicides at 5% level.

22. Family Planning in Cows—observations on the use and working capacity of desexed cows.

M. P. JOHARI and S. P. SHARMA, Mathura.

In countries where it is not possible to reduce the cattle population by slaughtering the animals, some checks have to be found out to keep the population in relation to the carrying capacity of the land. For improving the quality of cows, selection has to be made and unselected stock has to be prevented from promiscuous breeding. Better feeding seems to be possible only by reducing the number of animals kept so that the feed available can be distributed in larger share to each animal. This can be achieved by the sterilization of cows, heifers and also of male calves.

The sterilized or desexed cows can be used for work. These may be the most easily available source of additional work animals. The various physical changes after desexing the cows, the working capacity, the ease of training for work on such animals have been discussed.

The different techniques of sterilization applicable to our conditions have been critically studied and ovariectomy per vagina has been recommended as it would appear to be a painless, bloodless procedure.

Section XI, Physiology

1. Induction of oestrus by enucleation of corpus luteum in bovines and studies on the fertility rate at induced and subsequent oestrus.

S. N. LUKTKE, S. R. JOSHI and D. J. ROY, Izatnagar.

Mid-cycle corpus luteum was enucleated from the ovary of cows and buffaloes belonging to the experimental Haryana and Murrah herds of the Indian Veterinary Research Institute. During 1956-60, the corpus luteum was enucleated from 8 heifers, 65 cows and 22 buffalo cows. The corpus luteum was removed from the right ovary in 55.5% heifers, 62.1% cows and 45.8% of buffaloes. Oestrus was induced in all these animals within 10 days of the removal of corpus luteum. In 52 (82.6%) cattle and 21 (85.8%) buffaloes, oestrus was induced between 3-5 days after the treatment. The corpus luteum was enucleated twice during a single lactation in one heifer, one cow and two buffalo cows. All the animals were artificially inseminated during the induced heat. Four of the 8 treated heifers conceived at the induced and 3 at the subsequent oestrus. Twenty-nine (44.6%) out of 65 treated cows conceived at the induced and 16 at the first normal oestrus following the induced one. Out of 22 buffaloes that were treated, 10 (45.4%) conceived at the induced and 3 at the following normal oestrus. The intensity of oestrus at the induced heat was usually weak. It is recommended that animals should be inseminated on the 4th and 5th day following the enucleation of corpus luteum even when the oestrus symptoms evinced are not intense.

2. Studies on involution of uterus in buffaloes.

D. J. ROY and S. N. LUKTKE, Izatnagar.

Studies on involution of uterus were made on thirty-three Murrah buffalo cows of the Institute's experimental herd and fifty-four grade Murrah buffalo cows of the Military Dairy Farm, Bareilly. The average interval between parturition and the complete involution of uterus was found to be 39.3 ± 11.2 days ranging between

15 and 67 days. The involution of uterus was completed 39.6 ± 8.7 days on an average after parturition in the animals of the Institute's herd whereas in the animals of Military Dairy Farm, this interval was 39.1 ± 9.3 days. The difference in the interval was not however significant. The non-gravid horn of the uterus involuted 11.4 days earlier than the gravid one. The involution of the uterus was complete in 85% of the animals between 30 and 60 days post-partum. In 9.2% animals the involution was complete within 30 days of parturition. The rate of involution of uterus was rapid upto 14 days post-partum. Thereafter, the rate of receding gradually decreased and from 21 days onwards, it was considerably slow. The mean interval from parturition to involution of uterus in three groups of animals having 2 to 4, 5 to 7 and 8 or more calvings were 42.4, 35.0 and 40.3 days respectively. The difference in the mean intervals among the different groups was significant at 5% level. The rate of involution was found to have significant influence on post-partum conception rate.

3. Mechanism of panting in dogs.

M. S. CHAUDHRY, Jabalpur.

Author had read a paper at the Indian Science Congress held at Delhi in 1959. He had stated in that paper that his observations went against the view of Richet on the mechanism of panting in dogs.

Author has made further observations on panting in dogs after exercise. He has again confirmed that the panting in dogs does not depend on the external temperature. The panting cannot take place if the mouth of the dog is tied in such a way that it cannot be opened. He has again confirmed that panting in dog take place only when the rectal temperature has gone up.

Author has postulated that the mechanism of panting in dog requires a rise of internal temperature which probably influences the respiratory centres and the panting actually starts as a reflex phenomena when the mouth is opened if the internal temperature has increased. There is not much of difference in the mechanism of panting in the un-anaesthetised and anaethelised dog. Due to the effect of anaesthesia the temperature at which this phenoma takes place is raised.

4. Haematological and chemical studies on the blood of lambs maintained on adequate diet.

K. C. TANDON and P. G. DEO, Izatnagar.

In this paper investigations on the haematological and chemical constituents of the blood and the blood serum respectively of fifty lambs aged 2 to 3 months have been reported. The lambs were maintained on the adequate diet consisting of 70 parts of linseed cake, 30 parts of gram-husk and 44 parts of barley. Hay ad lib, greens at the rate of 4 ozs. per 10 lb. body weight, trace element mixture at the rate of 1 gm. twice a week and 5 ml. cod liver oil per week per animal were also given during the experimental period.

The results showed that the haemoglobin percentage of blood ranged from 9.6 to 11.8 gms. The percentage of cell volume varied from 33 to 39. The numbers of R.B.C. ranged from 11.12 to 13.96 millions per cu.mm., while the numbers of W.B.C. ranged from 10.45 to 15.90 thousands per cu.mm. of blood.

The percentage of crude protein varied from 5.875 to 6.6875. The inorganic calcium and phosphorus in blood serum ranged from 11.0 to 13.6 and 5.84 to 8.08 mg. per 100 ml. respectively.

5. The method of double sweep for the study of the cardiac rhythm in the decerebrate frog.

S. K. LAL, Pondicherry.

A cathode-ray oscillograph, equipped with a simple system, permits the recording of periodic phenomena in the form of a pattern (rhythmogram). This method of double-sweep has been applied to the study of cardiac rhythm of the decerebrate frog. It shows in an especially suggestive manner any variations of rhythm, and the variations can be accurately and easily measured. It permits recordings for long periods and examples are given of the variety of problems which can be studied with this technique.

The heart of the decerebrate frog has been observed to exhibit an extreme degree of stability.

REFERENCE

Distel, R. and Lal, S. K. (1960), C. R. Acad. Sc., Paris, 251 : 1134.

6. B.M.R. and body fat estimation of subjects exposed in high intensity sound.

CHANDRA SEKHAR NAIR and C. A. VERGHESE, Bangalore.

The Basal Metabolic Rates of field service mechanic of Jet aircraft in the age group 30 to 50 are determined; and the average value is found to be much lower than that of normal individuals of the same age group. Percentage body fat of the jet mechanics are found out by the skinfold technique using a pair of constant pressure calipers, the average percentage being 4.7 while the mechanics of propeller aircraft of the same age and economic group have an average percentage 9.2. Probable explanations for these observations are given.

7. Lipemia and serum viscosity in cholesterol atherosclerosis of the rabbit.

BALKRISHNA, R. N. CHAKRAVARTI and S. H. ZAIDI, Lucknow.

Serum viscosity has been shown to rise with the increase in serum lipids in cholesterol atherosclerosis of the rabbit. After the eight week period of feeding cholesterol, the increase in viscosity may be due to lipoproteins of a larger molecular dimension. The results are not related to clinical atherosclerosis in the human.

Section of Psychology & Educational Sciences

1. A Survey of the Problems faced by the First-year University Students.

(MISS) PREM PASRICHA, Baroda.

The purpose of this investigation was to study the number and types of problems faced by students during the first year of their stay at the University. Such a survey, it was felt, would help the work of Student Counselling Centre organized at the Maharaja Sayajirao University of Baroda.

The Inventory: Before any instrument for study of problems could be adopted the students were asked to list the problems that they faced during their first year at the University. Three hundred students listed about 600 problems in this manner. Out of this the different problems were sorted out and some were added with the help of literature in adolescence studies. In this way an inventory

was compiled with 234 items in five different areas : (1) Personal, (2) family, (3) Educational, (4) social and (5) vocational. The administration of this inventory was simple in the sense that the student had to read the item and mark it if it applied to him and if it did not he was not to make any mark against the space shown.

Sample : In all 542 students of the Preparatory Unit of the University checked this inventory. The sample though predominantly male (with only 60 girls) was distributed over the three sections of the Unit viz., Science, Commerce and Arts.

Analysis : Average number of problems faced by the population was calculated together with the averages for boys and girls, Science, Commerce and Arts and for the upper and lower socio-economic groups. The differences between the means of these different groups were tested for significance making use of the T-test. (The distribution was a normal one).

Results : Boys and girls did not show any significant differences in the number of problems that they faced.

Commerce group showed the highest mean of problems faced and when compared with Science and Arts students their differences proved significant at .01 level.

Lower S.E.S. group faced a large number of problems and the difference between the means of upper and lower S.E.S. groups proved significant at .01 level. As far as the types of problems was concerned the boys and girls showed no difference. The ten most frequent problems were the same for the two groups except that within these ten places of a couple of them differed according to their frequency.

Concluding Remarks : Most of these students checked a large number of problems and most of them were personal in nature than any other type marked on the inventory. Contrary to expectation, economic problems did not rank among the most frequent ten.

2. An Experimental Study of the Personality Pattern of Professional and Non-professional Students.

E. I. GEORGE, Kerala.

Three professional groups (Medical—101, Nursing—69, and Engineering—89) were studied with the helps of Guilford STDCR and the M.M.Q. Analysis of variance shows that Nursing students are more extraverted than either Medical or Engineering (F ratios relating to the S and R Scales between groups were found significant beyond the 5% level). Correlational analysis revealed that STDCR inventory measures two relatively independent factors of personality (Neuroticism—TD and C and Extroversion-introversion—S & R). This confirms many of the earlier studies reported in the literature.

3. A Study of the Diagnostic Validity of the Sentence Completion Test.

BIMALESWAR DE and GOSWAMI PARAMNAND GIRI, Muzaffarpur.

Problem : The present study was undertaken to test the diagnostic validity of the Sentence Completion Test. Symonds' characterisation of the test as descriptive and not evaluative was particularly kept in view.

Sacks' version of the test consisting of sixty incomplete-sentences relating to four major areas, viz., family, sex, interpersonal relationships and self-concept, was translated in Hindi and the Hindi version was used. All the instructions of the test were followed except that the timings were not recorded.

Sample used : Two groups of subjects used—one normal, (consisting of forty subjects, mostly college students), the other institutionalised, (consisting of twenty-five subjects).

Scoring : Each completed sentence was scored either as healthy or unhealthy or neutral, as the case might be. Responses expressing positive feelings were scored as healthy, those expressing negative feelings like conflict, anxiety, rejection, frustration, etc., and also sentences not completed were scored as unhealthy. Responses which did not express either positive or negative feelings but were of matter of fact in nature, were scored as neutral.

Treatment : Chi square was computed to test the significance of the obtained scores against the Null hypothesis. The groups were tested separately on the test as a whole as well as for each of the four areas comprising the test.

The distribution of responses under the three scoring categories, viz., healthy, unhealthy and neutral, was found significant at beyond .01 level for both the groups in respect to the test as a whole. But the results were of equally satisfying in respect to the distribution of responses for the different areas comprising the test.

Findings : Thus, the findings are indicative of the evaluative character of the test from the diagnostic point of view. One of the fruitful indications of the study was that the test could also be analysed from the side of the stimuli, i.e., the nature of the incomplete sentences, with a view to finding out their potency for evoking unhealthy responses, a line of approach not attempted so far.

Section XIII, Engineering and Metallurgy

1. On the Principle of obtaining Design Equations.

N. I. TAGANOV, Bombay.

The analytical method of obtaining design equations cannot be applied in all the cases because of the difficulty of formal integration of differential equations.

The empirical design equations obtained by establishing the relationship between the physical quantities on the basis of their values measured experimentally are in most cases of incidental form and do not express general regularities.

Therefore, the generalization of experimental data on the basis of empirical equations is impossible. The criterial equations obtained on the basis of the theory of similarity with experimental research make it possible to generalize the phenomena. However, in many cases they do not eliminate the necessity of integration of differential equations.

There is another method of obtaining design equations which is intermediate between the analytical and the empirical methods. It gives the possibility of the generalization and eliminates the necessity of solving differential equations.

The principle of this method is the establishment of relationship between the physical quantities by means of an equation having the form common for many phenomena.

The equations of the same form for many phenomena are obtained on the basis of the relation

$$a_1 \frac{dX_1}{X_1} = a_2 \frac{dX_2}{X_2} \dots \dots \dots (1)$$

where X_1 and X_2 are physical quantities determining the phenomenon;
 a_1 and a_2 are some functions of the physical quantities X_1 and X_2 .

In the general case, the functions of a_1 and a_2 in equation (1) are different for various phenomena.

In order to obtain the equation of the form common for many phenomena, in relation (1) a_1 and a_2 should be approximated by corresponding functions.

The approximation of a_1 and a_2 by some functions gives after the integration of relation (1), a number of equations having the form common for many phenomena.

Among these equations the one obtained by means of the approximations of functions a_1 and a_2 by logarithmic function of the second power is of great importance.

This equation in the case of n physical quantities has the form

$$\ln X_1 = \frac{\ln(A' X_2^{m'_2} X_3^{m'_3} \dots X_n^{m'_n})}{\ln(A X_2^{m_2} X_3^{m_3} \dots X_n^{m_n})} \dots \dots \dots (2)$$

where $X_1, X_2, X_3, \dots, X_n$ —physical quantities that characterize the phenomenon.
 $A, A', m'_2, m'_3, m'_n, m_2, m_3, \dots, m_n$ —constants to be determined experimentally.

The studies of equation (2) on a vast experimental data on various phenomena showed that this equation was accurate enough to describe many phenomena.

2. Beneficiation of Manganese Ores.

H. N. SINHA, Bombay.

The experimental work reported in the paper deals with the upgrading of highly siliceous Manganese Ores supplied by the Nagri Mining Company from their mines at Virnoli and Hudsa in Mysore State. Single roll magnetic separator with an adjustable magnetic field ranging from 8500—12000 Oersteds was used for the separation of silica content of the ores.

Virnoli ore with an average of 32% Mn and 42% SiO_2 was upgraded to 52.5% Mn with a SiO_2 content of the order of 6—7%. The concentration of manganese for Hudsa ore was on an average from 35% to 46%. In both the cases best results were obtained when the ores were crushed to the sizes ranging between -50 and +200 mesh.

3. Use of Relative Numbers for the Solution of Open Channel Problems.

R. M. ADVANI, Jodhpur.

1. Introduction

For a large variety of open channel problems such as computation of critical depth, determination of the elements of hydraulic jump, finding alternate depths for a given specific energy and similar other problems, the two very useful diagrams that have so far been in use are the specific energy diagrams and the impulse momentum curves. However, these diagrams are not very general in application and also very often are not suitable when a large number of computations are required for different discharges and/or for different channel sections, because this every time necessitates a new set of curves being plotted which makes the process a very cumbersome one. These difficulties can now be overcome by expressing the various channel flow equations in terms of relative numbers based on sound dimensional reasoning. The author has developed such

equations for a variety of open channel problems particularly those pertaining to hydraulic jump problems in trapezoidal channels. The familiar specific energy diagram coupled with impulse momentum curve for a given discharge Q in a channel of given profile has so far formed the basis for the solution of such problems.

The specific energy and total momentum equations are given by the expressions :

$$E = d + \frac{V^2}{2g} = d + \frac{Q^2}{2g^2 a}$$

$$\text{and } M = \frac{wQ^2}{g a} + w a x$$

In terms of non-dimensional parameters these equations for trapezoidal channels can be reduced to the forms :

$$\frac{E}{d_c} = \frac{d}{d_c} + \frac{d_c^2}{2d^2} \frac{\left(\frac{B}{nd_c} + 1\right)^3}{\left(\frac{B}{nd_c} + \frac{d}{d_c}\right)^2 \left(\frac{B}{nd_c} + 2\right)}$$

and

$$\frac{M}{w n d_c^3} = \frac{\left(\frac{B}{nd_c} + 1\right)^3}{\frac{d}{d_c} \left(\frac{B}{nd_c} + \frac{d}{d_c}\right) \left(\frac{B}{nd_c} + 2\right)} + \frac{d^2}{6d_c^2} \left(\frac{3B}{nd_c} + 2\frac{d}{d_c}\right)$$

With the help of these equations, generalized solution can be obtained.

4. New Methods of High Voltage Arc Interruption.

PAUL O. LANGGUTH, Bombay.

Atmospheric air, oil and compressed air have been used as interrupting media for arc extinction in circuit breakers for a number of years. Many improvements have been made by the development of various unique devices which mechanically cool and deionize the arc. However, the very fact that these media, as applied, in themselves support and enhance combustion, would lead the scientist and engineer to search for a medium which would effect more efficient and trouble-free quenching of the arc, especially since operating voltages and short-circuit capacity requirements are continually increasing. Recent developments during the past six years in the U.S.A. have culminated in the use of sulphur hexafluoride on one hand and high vacuum on the other as superior arc interrupting media. Both types of high voltage circuit breakers and switches using these two types of media are now in everyday service. It is the purpose of this paper to discuss the use of vacuum and sulphur hexafluoride as arc extinguishing media.

5. On the kinetics of corrosion of iron in acids in the presence of inhibitors and oxidizers at high temperatures.

I. P. ANOSHCHENKO, Bombay.

The problem has not only theoretical significance but also practical importance for industry, where it is necessary to reduce the corrosion rate of iron and steel and their products, which come in contact with acids at higher temperatures.

The effect of some metal cations, potassium bromide, urotropine, achrichin and their combinations on the corrosion of iron in sulfuric and hydrochloric acids in the presence of oxidizers (e.g., Oxygen and trivalent iron) has been investigated at 20—80°C. by volume-weight methods and by plotting polarization curves.

Of all the metal cations studied, Sn^{+2} and Al^{+3} were the most effective. The inhibitor efficiency increased with increasing crystallographic radius, temperature and acid concentration.

The combined effect of mixtures of inhibitors was found to exceed the sum of the individual effects. Thus, mixtures of potassium bromide, urotropine and achrichin containing stannous chloride or aluminium sulfate were found to be the most effective. The mixtures were rather more effective in sulfuric than in hydrochloric acid.

Another important observation has been that the introduction of certain compounds which have otherwise a strong inhibitor effect does not alter the rate of corrosion in some mixtures of inhibitors.

A probable explanation of experimental observations has been put forth.

DISCUSSION

I. ABSOLUTE SUMMABILITY FACTORS

Section of Mathematics

Chairman : B. N. PRASAD, Allahabad.

1. S. R. SINHA (Allahabad) : *Absolute summability factors of Fourier series and its conjugate series.*

The first application of the absolute summability factors to special infinite series is due to Prasad (*P.L.M.S.*, 1933), who established the following :—

$$\text{If } \int_0^t |\Phi(u)| du = o(t), \text{ as } t \rightarrow 0, \quad \dots \quad (1)$$

then $\sum \lambda_n A_n(x)$ is summable $|A|$, where $\{\lambda_n\}$ is any one of the sequences

$$\left\{ \begin{aligned} &\{(\log n)^{-1-\varepsilon}\}, \{(\log n)^{-1} (\log \log n)^{-1-\varepsilon}, \dots\} \\ &\dots \{(\log n)^{-1} \dots (\log \log \dots \log_p n)^{-1-\varepsilon}\} \quad (\varepsilon > 0). \end{aligned} \right\} \quad \dots \quad (2)$$

Since condition (1) holds for almost all values of x , it follows that factors of the type (2) are absolute Abel-summability factors of a Fourier series almost everywhere. In 1938, Izumi and Kawata extended this result to the case of factors λ_n , where $\{\lambda_n\}$ is a convex sequence such that $\sum (\lambda_n/n) < \infty$. Cheng in 1948 extended Prasad's theorem in another direction by replacing summability $|A|$ by summability $|C, \alpha|$, $\alpha > 1$. In 1954, Pati generalized Cheng's result by replacing sequences (2) by a convex sequence $\{\lambda_n\}$, where $\sum (\lambda_n/n) < \infty$.

This result has been further extended by Dikshit by replacing (1) by

$$\int_0^t |\Phi_k(u)| du = O\{t(\log^1/t)^\beta\}, \quad \beta \geq 0, \text{ as } t \rightarrow 0 \quad \dots \quad (3)$$

where $k=0$, and the sequences (2) by $\{\lambda_n (\log n)^{-\beta}\}$, $\{\lambda_n\}$ being a convex sequence, and such that $\sum (\lambda_n/n) < \infty$

Pati's result has been recently generalized by Pati and Sinha (*Indian Journal of Maths.*, 1958-59) in another direction by introduction of a new concept of *hyper-convexity*. A sequence $\{\lambda_n\}$ is said to be hyper-convex of order h , ($h=0, 1, 2, \dots$) if $\Delta^{1+h} \lambda_n \geq 0$. By definition hyper-convexity of order zero is the same as convexity.

Chow established (*J.L.M.S.*, 1941) that for a convex sequence $\{\lambda_n\}$ such that $\sum (\lambda_n/n)$ is convergent, the series $\sum \lambda_n A_n(t)$ is summable $|C, 1|$ for almost all values of t . He based the proof of his theorem on a result of Marcinkiewicz concerning the strong summability of Fourier series. The set of points at which his result holds, is not necessarily the Lebesgue-set in which Prasad's theorem holds.

Cheng (*Duke M. J.*, 1948) proved that if $0 \leq \alpha \leq 1$ and $\Phi_\alpha(t)$ is of bounded variation in $(0, \pi)$, then $\sum \lambda_n A_n(x)$ is summable $|C, \alpha|$, where $\lambda_n = (\log n)^{-1-\varepsilon}$, $\varepsilon > 0$. Subsequently Sunouchi (1954) extended this result to all positive values of α . In 1957, Prasad and Bhatt (*Duke M. J.*) also generalized Cheng's theorem in another direction and proved some new results on the absolute Cesàro-summability factors

of Fourier series. Recently some of the theorems of Prasad and Bhatt have been extended by Dikshit (PNISI, 1959).

There have been proved several other extensions and generalizations of the theorem of Cheng (Duke M. J., 1947, 48) by Cheng himself, Prasad and Bhatt, Dikshit and Pramila Srivastava (PNISI, 1958), the last one being of the most general type.

The absolute Riesz summability factors of Fourier series have been considered by various authors like Mohanty, Mohanty and Misra, Matsumoto, Bhatt, Pramila Srivastava and Dikshit; and the absolute Nörlund summability factors for the Fourier series have been recently discussed by Varshney (Proc. A.M.S., 1959) for the first time.

2. S. N. BHATT (Allahabad) : *Local property of absolute summability of a factored Fourier series.*

1. Let $f(t)$ be integrable (L) over $(-\pi, \pi)$, and periodic with period 2π , and let its Fourier series be given by

$$\frac{1}{2}a_0 + \sum (a_n \cos nt + b_n \sin nt) = \sum A_n(t).$$

2. Izumi (Tôhoku M.J., 1950) and Mohanty (J.L.M.S., 1950) have independently proved that the summability $|R, \log n, 1|$ of a Fourier series is not a local property of the generating function. Matsumoto (T.M.J., 1956) has generalized the above result by proving that the summability $|R, \log n, 1|$ of $\sum A_n(t)/\log \log n$ is not a local property. A reason of this failure may be that the Lebesgue integrability of $f(t)$ over $(-\pi, \pi)$ by itself, does not warrant anything beyond the asymptotic order estimate, viz. $A_n(t) \rightarrow 0$, as $n \rightarrow \infty$. It may, therefore, be interesting to investigate whether, by imposing somewhat greater restriction upon the behaviour of $A_n(t)$, we can make the summability $|R, \log n, 1|$ of the factored Fourier series at a point depend only on an additional condition of a local character, that is a condition defining the behaviour of $f(t)$ in the immediate neighbourhood of the point considered.

In this direction Mohanty has demonstrated that the summability $|R, \log n, 1|$ of (2.1) $\sum A_n(t)/\log n + 1$, at $t=x$, is a local property of the generating function of $\sum A_n(t)$. Matsumoto has improved this result by replacing the series (2.1) by (2.2) $\sum A_n(t)/\{\log \log(n+1)\}^{1+\varepsilon}$, $\varepsilon > 0$.

Very recently Bhatt (P.N.I.S.I., 1960) has replaced the factor $(\log \log n + 1)^{-1-\varepsilon}$, of the series (2.2) by the more general factor $\{\lambda_n \log n\}$, where $\{\lambda_n\}$ is a convex sequence such that $\sum n^{-1} \lambda_n$ is convergent. In some different forms Pramila Srivastava has also proved some results in this direction (Proc. I.S.C.A., 1958).

3. G. D. DIKSHIT (Allahabad) : *Absolute Riesz summability factors for infinite series.*

Let a given infinite series $\sum a_n$ be absolutely summable by Riesz means of a certain 'type' and of a certain 'order'. If either or both of the 'type' and 'order' of Riesz summation are changed then, though, in general, the series $\sum a_n$ itself may not be summable by the resulting process of absolute Riesz summability, it is possible to choose a sequence $\{\varepsilon_n\}$ such that the product series $\sum a_n \varepsilon_n$ becomes summable by the new method. Such sequences are known as absolute summability factors for Riesz summability. Actually their function is more than what we have just enunciated. Though the scope of absolute summability factors for Riesz summability is very wide, the investigations made so far in this field, are comparatively very few.

The general idea expressed by the so called 'second theorem of consistency' for absolute Riesz summability is that a series which is summable $|A, \lambda, k|$, $k > 0$, is also summable $|R, \Phi(\lambda), k|$, provided that, roughly speaking, $\Phi(w)$ does not increase very much more rapidly than w , and that its rate of increase is reasonably regular. Thus, in particular, if a series is summable $|R, \lambda, k|$, $k \geq 0$, then it is also summable $|R, \mu, k|$, where $\{\mu_n\} = \{\log \lambda_n\}$. The converse of this theorem is in general not true. In this direction in 1950, Mohanty proved (J.L.M.S.) that if a series $\sum a_n$ is summable $|R, \lambda, 1|$, then the series $\sum a_n/\lambda_n$ will be summable $|R, \mu, 1|$, where $\{\mu_n\} = \{\exp(\lambda_n)\}$. This theorem of Mohanty was extended for all positive values of summation by Tatchell (J.L.M.S., 1954) who proved that the summability $|R, \lambda, k|$, $k \geq 0$, of $\sum a_n$ implies the summability $|R, \mu, k|$ of $\sum a_n (\lambda_n)^k$, where $\{\mu_n\} = \{\exp(\lambda_n)\}$. Another extension to the result of Mohanty for the order of summation unity was done by Matsumoto (T.M.J., 1956). Simultaneously, Guha proved (J.L.M.S., 1956) comparatively a more general theorem. He has investigated into the nature of sequences $\{\varepsilon_n\}$ of factors such that the factored series $\sum a_n \varepsilon_n$ may be summable $|R, \mu, k|$ whenever $\sum a_n$ is summable $|R, \lambda, k|$, ($k \geq 0$; and integral), the function $\mu = \mu(\lambda_n)$, representing the 'type, being a logarithmico-exponential function. This theorem of Guha includes the theorem of Tatchell mentioned above, for the integral order of summation. Recently Dikshit has proved (Indian J.M. 1958-59) a general theorem for integral order of summation, which includes all the previously known results in this line. Very recently Dikshit has also proved (P.N.S.I., 1960) a theorem for the non-integral order of summation in the extension of his previous theorem.

Various results are known on absolute summability factors connecting the $|C, \alpha|$ summability of $\sum \varepsilon_n$ with the $|C, \beta|$ summability of factored series $\sum a_n \varepsilon_n$ where $\alpha \stackrel{>}{\sim} \beta$. But it is strange that no general theorem has been established in this direction for absolute Riesz summability so far. Recently, dealing with the $|R, \lambda, 1|$ —summability of a Fourier series, Dikshit, in an unpublished paper, has succeeded to show that if $\sum a_n$ is summable $|R, \lambda, 1|$ and the sequence $\{\varepsilon_n\} = \{1 - \lambda_n/\lambda_{n+1}\}$ is monotonic non-increasing, then the series $\sum a_n \varepsilon_n$ is absolutely convergent.

Very recently Dikshit has proved the following limitation theorem for absolute Riesz summability. Let α and β be positive integers such that $0 \leq \alpha < \beta$. If $\sum a_n$ is summable $|R, \lambda, \beta|$ and if the sequence $\{\lambda_n/\lambda_{n+1}\}$ is of bounded variation, then $\{(1 - \lambda_n/\lambda_{n+1})^\beta \alpha A^\alpha(\lambda_n)\}$ is a sequence of bounded variation. As a special case of this theorem, we see that if $\lambda_n = C^n$, where $C > 1$, then the summability $|R, C^n, \beta|$ of a series $\sum a_n$ implies its absolute summability of any positive order lower than β , and in particular, its absolute convergence. And thus in this case we see that we do not need any summability factor to go to summability $|R, C^n, \alpha|$ of $\sum a_n$ from its summability $|R, C^n, \beta|$.

4. T. PATI (Allahabad) : "Absolute Cesàro summability factors of infinite series."

The earliest result on absolute Cesàro summability factors of infinite series seems to have been contained in the result of Kogbetliantz (1925) : if $\sum a_n$ is summable $|C, \delta|$, $\delta \geq 0$, $\sum a_n n^{-\gamma}$ is summable $|C, \delta - \gamma|$, $0 \leq \gamma \leq \delta$. A short proof and an extension to $\delta < \gamma$ are available respectively in Peyerimhoff, Arch. Math., 3, 1952, 262-265 and Sunouchi, Jour. Math. Soc. Japan, 1, 1949, 122-129. In an attempt at obtaining necessary and sufficient conditions that $\sum \varepsilon_n a_n$ be summable $|C, \rho|$ whenever $\sum a_n$ is summable $|C, \kappa|$ for fixed ρ and κ , Bosanquet gave *inter-alia* the following : (J.L.M.S., 1945) : if $0 \leq \rho \leq \kappa + 1$, necessary and sufficient (n.s.) conditions are (i) $\sum n^{k-\rho} |\varepsilon_n| < \infty$; (ii) $\sum n^k |\Delta^{k+1} \varepsilon_n| < \infty$. The corresponding problem for $\rho > \kappa + 1$ has been settled by Tatchell (JLMS 29, 1954, 207-211) *via* the following :

n.s. conditions that $\Sigma \varepsilon_n a_n$ be summable $|A|$ whenever Σa_n is convergent are :
 (i) $\Sigma |\Delta \varepsilon_n| < \infty$ (ii) $\Sigma n^{-1} |\varepsilon_n| < \infty$. In the cases in which ρ and k are non-integral, Andersen (1953) (Skandina. Mateimatikerkongressen, Lund) extended some of Bosanquet's results, while Chow (JLMS, 1954) proved : ($\alpha, \beta \geq 0$; $q \geq 0$) n.s. conditions that $\Sigma \varepsilon_n a_n$ be summable $|C, \alpha|$ whenever $a_n = O(n^q)$ (C, β) are : (i) $\Sigma n^{\beta-\alpha-1+q} |\varepsilon_n| < \infty$, i) $\Sigma n^{-1+q} |\varepsilon_n| < \infty$ and (ii) $\Sigma n^{\beta+q} |\Delta^\beta(n^{-1}\varepsilon_n)| < \infty$. Later (1937, JLMS) Bosanquet and Chow proved, by means of equivalence with this result, the following : ($k \geq -1$, $\rho \geq 0$, $q \geq 0$) n.s. conditions that $\Sigma \varepsilon_n a_n$ be summable $|C, \rho|$ whenever $\varepsilon_n^k = O(n^q)$ are (i) $\Sigma n^{k-\rho+q} |\varepsilon_n| < \infty$, i) $\Sigma n^{-1+q} |\varepsilon_n| < \infty$, ii) $\Sigma n^{k+q} |\Delta^{k+1}\varepsilon_n| < \infty$. In view of the rather indirect demonstration of this theorem, Pati and Ahmad decided to evolve a direct approach to the problem, and succeeded in a series of papers (Tôhoku Math. J., 1960, Indian J. Maths., 1960, Jan. & July) in giving direct proof of the following more general result : ($k = \rho \geq 0$) n.s. conditions that $\Sigma \varepsilon_n a_n$ be summable $|C, k|$ whenever $\varepsilon_n^k = O(\lambda_n)$ (λ_n) positive, m.n.d.) are : (i) $\Sigma \lambda_n |\varepsilon_n| < \infty$, and (ii) $\Sigma n^k \lambda_n |\Delta^{k+2}\varepsilon_n| < \infty$. The case $k \neq \rho$ has more recently been disposed of by Ahmad. Analogous to a previous result of Bosanquet for (C) summability factors, Mrs. B. Tyler has proved : ($k, \rho \geq 0$, integers) n.s. conditions that $\{s_n \varepsilon_n\}$ be summable $|C, \rho|$ whenever $\{s_n\}$ is summable $|C, k|$ are (i) $\varepsilon_n = O(n^{\rho-k})$, (i) $\Sigma o_n \varepsilon_n = O(n)$ (ii) $\Delta^{k-1} \varepsilon_n = O(n^{1-k})$ (ii) $\Sigma |\Delta^{\rho}(\varepsilon_n)| < \infty$.

Motivated by problems concerning absolute summability factors of Fourier series, Pati (Duke M.J., 1954) and Sunouchi (Kodai Math. Sem. Report, 1954) and others have given theorems on the absolute C-summability factors of infinite series in general, of which the following are typical : Pati : if $\{\lambda_n\}$ is convex such that $\Sigma n^{-1} \lambda_n$ is convergent that $\theta_n^k = |t_n^k|$ or $\max |t_n^k|$ acc. as $k=1$, $0 < k < 1$, t_n^k denoting the n th C-mean order k of $\{\lambda_n\}$, is bounded $(C, 1)$, then $\Sigma \lambda_n a_n$ is summable $|C, k|$. A better result, if $\lambda_n = (\log n)^{-1-\varepsilon}$, $\varepsilon > 0$, by Sunouchi : ($\sigma \geq 0$) if $\Sigma_1^n |s_\nu^\sigma - s_{\nu-1}^\sigma| = O(\log n)$ then $\Sigma \lambda_n a_n$ is summable $|C, \alpha|$. Later authors like Prasad and Bhatt (Duke M.J., 1957) and Dikshit (PNISI, 1959) and Ahmad have generalised these theorems. In trying to settle the outstanding question whether on the Lebesgue set $|C, 1|$ -summability of Fourier series with factors λ_n of the aforesaid type can be ensured, Pati (Abstract, Proc. 25th Conf. IMS, 1959) has proved : if $\Sigma_1^n n^{-1} |s_\nu| = O(\log n)$, then $\Sigma \lambda_n a_n$ is summable $|C, 1|$.

5. Miss PRAMILA SRIVASTAVA (Allahabad) : Absolute summability factors for integrals.

The general summability factor problem is concerned with the nature of the sequence $\{f_n\}$ or the function $f(x)$ such that summability P of the given series Σa_n , or the given integral $\int f(x) dx$, should imply summability Q of the factored series $\Sigma a_n t_n$, or the factored integral $\int f(x) d\alpha(x)$, where P and Q are two specified methods of summation. The relationship between the methods P and Q may be that of independence, equivalence, or inclusion. It is in the last two cases that the problem is of greater interest. For series the known results in this direction embrace quite a variety of methods P and Q , whereas for integrals these seem to be confined mostly to the case of summability methods depending on the (C, k) -means. If Q be an absolute summability method, then the factor $f(x)$ may be termed an absolute summability factor.

The first absolute summability factor theorem for an integral, which may be ascribed to Obrechhoff (1929), is to the effect that if $\int f(x) dx$ is summable $|C, k|$, then $\int e^{-sx} f(x) dx$ is also summable $|C, k|$ where the real part of s is greater than

zero. If the factor e^{-kx} be replaced by the factor x^{-k} , then also the above remains true (Chandrasekharan and Minakshisundaram, 1952). A much more general theorem, involving necessary and sufficient conditions to be satisfied by $f(x)$ such that from summability $|C, k|$ of the given integral $\int a(t)dt$, summability $|C, k|$ of the factored integral $\int f(t)z(t)dt$ may be obtained, is due to Borwein (1951, 1954). Sufficient conditions to be satisfied by $f(x)$, in order that from summability (C, k) of $\int dz(x)$, summability $|C, k+1|$ (k is an integer) of the factored integral $\int f(x)dz(x)$ may be deduced, were given by Bosanquet (1948). Necessary and sufficient type conditions for the same, when k is not necessarily an integer, have been given by Borwein (1954). In the case of series there are summability factor theorems, which give necessary and sufficient conditions to be satisfied by $\{f_n\}$ such that summability $|C, \mu|$ of $\sum a_n f_n$ follows from (i) summability $|C, k|$ of $\sum a_n$, $0 \leq \mu < k$, and from (ii) summability (C, k) of $\sum a_n$, $0 \leq \mu < k+1$. That significant integral analogues of these theorems do not hold, has been shown by Sargent (1957). For series there is another theorem to the effect that if k is zero or a positive integer, then in order that $\sum a_n f_n$ be summable $|A|$, whenever $\sum a_n$ is summable (C, k) , it is necessary and sufficient that $\sum n^k |\Delta^{k+1} f_n| < \infty$ and $\sum n^{-1} |f_n| < \infty$. Sargent (1957) has proved that there is no significant infinite integral analogue of the result also. Recently (1958, 1960) I have obtained sets of sufficient conditions to be satisfied by $f(x)$ in order that summability Q of $\int f(x)dz(x)$ may follow from summability P of $\int dz(x)$, when (i) P stands for $[C, k]$ and Q for $|C, k|$, (ii) P stands for $[C, k, q]$ and Q for $|C, k, q|$, $q > 1$, and (iii) P stands for $|C, k, q|$ and Q for $|C, k, p|$, $1 \leq p < q$.

II. OPERATIONAL RESEARCH

Chairman : DR. R. S. VARMA, Delhi.

1. DR. S. S. SRIVASTAVA (Delhi) : *Economic retention period of surplus stores.*

A method has been discussed to decide on economic grounds whether a stock of repairable equipment which cannot be handled within the existing capacity of the base workshop is worth keeping. There is an economic time and an optimum economic reserve for every surplus stock depending upon the costs of storage, obsolescence, disposal value of the equipment and rate of interest. A table has been worked out to find the economic time if the above costs are known in % of the Unit cost of equipment.

A method has also been worked out which enables to calculate economic retention quantity of material having known shelf-life and following a Normal Probability Law of obsolescence and deterioration.

2. C. MOHAN and R. C. GARG (Delhi) : *Decision on retention of excess stock having a constant rate of obsolescence and deterioration.*

In this paper a method has been developed which can be employed to calculate Economic Retention Quantity for excess stocks having a constant rate of obsolescence and deterioration. Also the 'Sorting Costs' incurred at prescribed intervals are taken into account while assessing the retention costs. These sorting costs arise because after prescribed intervals it is found necessary to carry out technical tests to ascertain the number of articles fit within certain tolerance limits,

3. C. MOHAN, P. P. SANGAL and R. C. GARG (Delhi) : *Dependability of a system with variable failure rate.*

This paper gives a method to obtain the probability of operability of a system at a particular instant. Attempts have already been made (Cf. Hosford, J. E.) to define measures of dependability in terms of such probabilities. Hosford, however, gives complete analytical treatment for a problem where the systems' failure and repair distribution are exponential. We here give a method for more general models and have indicated that the relevant differential equation governing the system reduces to Hosford's equation for constant failure and repair rates. Two systems are considered which differ in as much as that the probability in one depends upon the previous occurrences of failures while in the other it is independent of it.

4. N. K. JAISWAL (Delhi) : *Priority Discipline in Queuing Theory.*

The two types of priority disciplines existing in Queuing literature are the 'Head-of-the-Line' priority discipline introduced by Cobhans and the preemptive priority discipline. A third type of priority discipline applicable only to a particular type of operational situation is due to Jaiswal and Jain. Head-of-the-line priority problem has been further investigated by Miller using the imbedded-Markov-chain technique but the preemptive priority problem has yet not been completely solved for general service time distributions. In this paper an attempt has been made to formulate such problems and to further analyse the preemptive priority problems.

5. N. U. PRABHU (Dharwar) : *The Theory of Queues.*

This paper reviews some of the work done in the field of the "Theory of Queues". In Section 1, the basic concept of the queue problem has been introduced. Section 2 deals with the evaluation of the operational parameters such as queue length, waiting time distribution for the simple queues M/M/1 and M/M/S. Section 3 deals with the more general problem M/G/1. The result for the waiting time distribution has been obtained in an explicit form by solving an integro-differential equation due to Taka'cs (1955) and the expression of the length of the busy period has also been obtained in an explicit form. Section 4 discusses the application of the imbedded-Markov-chain technique to solve queuing problems with general input or general service time distribution. Finally the waiting time distribution for the queuing process G1/G/1 has been shown to satisfy an integral equation of the Weiner-Hopf type and the solution in particular cases, given by Lindley (1952) has been mentioned.

6. DR. K. S. RAO (New Delhi) : *Operational Research in relation to the Food Problem.*

The conventional economic theory assumes that the amount of food-grains exported from a district depends only on the price level, that is $x=f(p)$ where x is the quantity of grains exported and p is its price.

In this paper, the author considers the model in which the export level depends not only on the price level but also on the amount of surplus (ξ) so that $x=f(p, \xi)$. Other assumptions, which are quite reasonable, are that

$$\frac{\partial x}{\partial \xi} > 0 \text{ and } \frac{\partial^2 x}{\partial \xi^2} > 0.$$

This model has been applied to the data collected from a large number of wheat producing districts in India.

Mr. A. Rehman, who spoke for a few minutes, outlined the activities of the Operational Research Society of India. He promised to take up cause of the individuals and institutions, who wanted to undertake an O.R. project, with the governmental authorities to give some financial help.

III. 'MANY BODY PROBLEM'

Jointly with the Section of Physics

Chairman : DR. D. S. KOTHARI, Delhi.

N. PANCHAPAKESAN : *Liquid Helium and the Many Body Problem.*

A review is made of the recent attempts at theoretical explanation of the behaviour of liquid helium. The main success has been in calculating the partition function at zero temperature by perturbation methods. The normal perturbation series diverges. A rearrangement of terms suggested by Brueckner and co-workers lead to a series which can be more easily handled. Using this method Brueckner and Swada have obtained the Landau relation between energy and momentum for a quasi particle in Helium liquid. The limited success of attempts being made to calculate the thermodynamics of liquid helium is pointed out.

V. K. TEWARY : *On the mass-radius relationship for planets taking into account the effect of correlation energy.*

The radius of a cold body goes on increasing with mass till pressure ionisation sets in. Then the radius starts decreasing with mass. The equilibrium configuration is a balance between the Gravitational and kinetic pressure. Electrostatic interaction reduces the kinetic pressure. It is further reduced because of correlations between the electrons. The effect of correlation is studied by including the Gellmann-Brueckner energy in the Virial. The non-applicability of Bohm-Pines theory is also discussed.

Dr. D. S. Kothari in his talk pointed out the importance of co-operative phenomena in the study of superfluidity and superconductivity. To demonstrate its similarity to the optical potential he derived the Ground-state energy of hard sphere gas by using the Dispersion formula. He mentioned the possibility of superfluidity in He^3 and gave information about the work going on in Russia in calculating the transition temperature.

TRILOCHAN PRADHAN (Cuttack) : *Application of Brueckner theory to liquid He.*

1. There have been some experiments to determine the excitation spectrum of liquid He by scattering low energy neutrons on liquid He. Could you comment on the agreement or otherwise of these experimental results with the Landau spectrum?

2. Have there been attempts to take into account the tertiary collision interactions in liquid He? Is it possible to make an estimate of the contributions due to these interactions?

N. PANCHAPAKESAN : *Liquid Helium⁴ and many body problem.*

- Q. Please comment on the verification of Landau Spectrum by (Pradhan) Neutron Scattering.
- A. Yes. This has been done in U.S.A. and the spectrum obtained from slow neutron scattering agrees very well with Landau's.
- Q. How far is the hard sphere approx. justified (He⁴) ?
- A. It is difficult to say. This has been discussed by Atkins in his recent book on "Liquid Helium". But before we consider forces of Lenard Jones type, this seems as a simple useful model.
- Q. Have tertiary collisions been taken into account or has it been shown that they are negligible?
- A. No. They have not been taken into account so far. The binary collision itself has many difficulties of its own. It has not been shown that they are negligible but if the binary collision is enough we need not bother about it.
- Q. Has the mechanism of transfer of the particle from one fluid to another been worked out?
- A. This would be a study of the phase transition and work is going on in this direction in many places.

I. STOCHASTIC PROCESSES

Section of Statistics

Chairman : DR. G. R. SETH, New Delhi.

INTRODUCTION

The modern theory of Stochastic processes was developed to accommodate probabilistic relations in time series analysis, during the twenties and thirties of this Century, with the pioneering works of Norbert Wiener, P. Levy, Kolmogoroff and Khintchine, and Doob. Within this short period it has grown into massive theoretical structure with ramifications in various applied fields as far apart as epidemiology, genetics, construction of dams, the study of turbulent fluids, electronics etc. The probabilistic models in many cases are rather crude and simple chosen with a view to make them mathematically tractable but the results often depict the real situation better than the conventional deterministic models. That sequence of random variables may behave in queer fashion was noticed by Yule in considering moving averages of a random sequence, which showed an unexpected kind of periodicity. Similarly in epidemiology the process of the growth of an epidemic showed peculiar features not explained by the older deterministic theory. That the probabilistic model would be more realistic than deterministic ones must have occurred to Statisticians in older times but they might have been scared by the mathematical difficulties involved, and finally the theory of Stochastic processes was built on the theory of measures in infinite dimensions which was developed during this period. The theoretical structure having now been developed, the attempt should be in further and deeper applications of it in observed phenomena and I hope efforts will be directed to this end.

1. DR. M. N. GHOSH (New Delhi) :

The theory of stochastic process was developed during the thirty years for the systematic statistical analysis of time series where the phenomena are evolving through time so that it is possible to conceive of an one fold continuum of observations each subject to random variations. A systematic statistical analysis of such ordered set of random variables $x(t)$ is possible where one can assume some structure for these variables. A type of structure commonly occurring in physical problems is the stationarity of the process i.e. when

$$r(s, t) = E\{x(s)x(t)\} - E\{x(s)\}E\{x(t)\}$$

depends only on $s-t$. An important tool in the analysis of stochastic process is the spectrum analysis of the process. The spectral theory of stochastic process is a generalisation of the spectral theory of positive definite functions considered by Herglotz and Bochner, where any positive definite function $r(t)$ is expressed

$$\text{as } r(t) = \int_{-\infty}^{\infty} e^{itx} dF(x)$$

$F(x)$ being a nondecreasing function. For stationary processes one considers instead of a nondecreasing function $F(x)$ as an additive stochastic process $Z(t)$ with orthogonal increments i.e. where $Z(s)-Z(t)$ is orthogonal to $Z(s)$ when $s < t$ and we

get a representation of the process $x(t) = \int_{-\infty}^{\infty} e^{it\lambda} dZ(\lambda)$ the integral being defined

as the limit in the mean of Riemann sums. This was proved by Khintchine. Karhunen has generalised the spectral theory to any stochastic process for which $r(s, t) = \int f(s, \lambda) \overline{f(t, \lambda)} dF(\lambda)$ and shown that if the set of functions $\{f(t, \lambda)\}$ is complete in $L_2(F)$ then we can find a stochastic process with orthogonal increments $Z(t)$ so that

$$x(t) = \int f(t, \lambda) dZ(\lambda)$$

If now $r(s, t)$ is the kernel of an integral equation $u(t) = \lambda \int r(s, t) u(s) ds$ and if the eigen-functions of the equation form a C.O.N. system with eigen values $\{\lambda_\nu\}$ we get a representation

$$r(s, t) = \sum \frac{u_\nu(s) \overline{u_\nu(t)}}{\lambda_\nu}$$

Thus from Karhunen's theory we can find a sequence of mutually orthogonal random variables $\{Z_\nu\}$ so that

$$x(t) = \sum \frac{u_\nu(t)}{\sqrt{\lambda_\nu}} Z_\nu$$

These methods have useful application in the structural analysis and prediction in time series and very interesting applications have been made to the theory of statistical inference e.g. in the derivation of the Kolmogoroff-Smirnov tests.

2. DR. J. MEHDI (Gauhati) : *The Spectral Function of the Stationary Stochastic Process.*

For a process X_t , discrete, real and stationary at least up to the second order, the stochastic average $E\{X_t\}$ is a constant m (which for convenience is put zero), and the autocovariance function $C_{t_1-t_2} = E\{X_{t_1} X_{t_2}\}$ is a function of the difference

(t_1-t_2) . The function C_s can be represented as $C_s = \int_0^\pi \cos(s\lambda) dF(\lambda)$, where $F(\lambda)$ has

the form of a distribution function in $(0, \pi)$, and is called the integrated spectrum of the process. The knowledge of the spectrum gives us information about the structure of the process. Apart from being of theoretical interest, the spectrum has various practical applications also. The basic problem is the estimation of the spectrum from a time series or a partial realisation $X_1, \dots, X_n$ of the process.

Consider the case where $F(\lambda)$ has a continuous spectral density function $f(\lambda)$;

then $C_s = \int_0^\pi \cos(s\lambda) f(\lambda) d\lambda$, which has the inversion formula $f(\lambda) = \frac{1}{\pi} \sum_s C_s$

$\cos(s\lambda)$. Estimation of $f(\lambda)$ involves not just a single parameter but an entire function

or a denumerable set. $\hat{C}_s = \frac{1}{n} \sum_{r=1}^{n-s} X_r X_{r+s}$ has desirable properties as an estimate

of C_s . For large n , $\hat{C}_s$ converges to C_s but not uniformly in s , and hence $I_n(\lambda) = \frac{1}{\pi} \sum_s \hat{C}_s \cos(s\lambda)$ (which is the classical periodogram) does not converge to $f(\lambda)$. The periodogram $I_n(\lambda)$ is an asymptotically unbiased estimate of $f(\lambda)$ but is not consistent. Attempts have been made to obtain consistent estimates of $f(\lambda)$ by smoothing the periodogram. By introducing a weighting function $v_\lambda(w)$, a class of estimates

$$\hat{f}_n(\lambda) = \int_0^\pi I_n(w) v_\lambda(w) dw$$

has been obtained (Grenander). Typical choices of the weighting function are the Dirichlet Kernel and the Féjér Kernel. To examine the efficiency of the estimates, in addition to variance, another measure—a measure of 'resolvability' has to be introduced. The measure suggested by Grenander has been generalised. Putting

$U_1(r) = [E\{|w-\lambda|^r\}]^{1/r}$, $r > 0$, and $U_2 = (n/2\pi) \text{var}\{\hat{f}_n(\lambda)\}$, it can be shown that the product $U_1(r) U_2$ has a positive minimum and this fact could be utilised to measure the efficiency of estimates. The optimum weighting function has been investigated. Under certain conditions

$$\hat{f}_n(\lambda) = (3/4h) \int_{\lambda-h}^{\lambda+h} \left[1 - \frac{(w-\lambda)^2}{h^2}\right] I_n(w) dw$$

is a sort of ideal estimate (Bartlett and Medhi).

3. DR. B. P. ADHIKARI (Lucknow) : *Test of Hypotheses for Continuous Parameter Stochastic Processes.*

Let (X, S, M) be a probability measure space, where X is a sample space, S a σ -field of sets in X and M a class of probability measures on the sets of S . The general problem of tests of hypotheses regarding the measures of M has been studied from the point of view of various definitions of "error". The actual decomposition of X for any of these tests makes use of Radon-Nikodym derivatives of these measures with respect to some dominating measure.

Suppose now that $X = \{x_t, t \in T\}$ is a stochastic process where the parameter t takes values in an index set T . Let $B(F_T)$ be the smallest σ -field containing the field F_T of sets like $[\{x_{t_1}, \dots, x_{t_n}\} \in A]$, where A is an n -dimensional Borel set. Obviously, $B(F_T) \subset S$. If we consider the problem of testing hypotheses in the measure space $(X, B(F_T), M)$, the general methods indicated above can be applied. We are concerned with the actual calculation of the Radon-Nikodym derivatives.

A stochastic process is usually known in terms of the "finite dimensional distributions" (or "loi temporelle") of the random variables of the process. Let $\mu^{(n)}(x_{t_1}, \dots, x_{t_n})$ denote the p.d.f. of the variables $x_{t_1}, \dots, x_{t_n}$ with respect to the probability measure μ in M . It was shown by Grenander that if T is a denumerable set then, for $\mu_1 \ll \mu_2$,

$$d\mu_1/d\mu_2 = \lim_{n \rightarrow \infty} \frac{f_{\mu_1}^{(n)}(x_{t_1}, \dots, x_{t_n})}{f_{\mu_2}^{(n)}(x_{t_1}, \dots, x_{t_n})} \dots \dots \dots (1)$$

It would be interesting to see how, in the case when T is a continuous interval, $d\mu_1/d\mu_2$ can be found in terms of a discrete subset of T . It can be shown then, given $d\mu_1/d\mu_2$, a denumerable sequence $\{t_j\}$ exists in T such that (1) holds. But this sequence depends upon the function $d\mu_1/d\mu_2$, and hence this result is interesting only as an existence theorem.

In order to see if a sequence $\{t_j\}$ can be found independent of the function $d\mu_1/d\mu_2$, let us confine ourselves to stochastic processes which are locally continuous in probability for all the probability measures of M . All the well-known stochastic processes have this property. It can then be shown that if $\{t_j\}$ is any sequence which is everywhere dense in T , the relation (1) holds.

As a consequence of the above, it follows that if M is a dominated class of measures, then $[x_t, t \in \{t_j\}]$ is a sufficient transformation from a space of real functions on an interval into a space of sequences. For problems of decision, therefore, continuous parameter stochastic processes which are locally continuous in probability need be observed only at time points in a denumerable set in T , which is everywhere dense in T .

4. DR. P. V. KRISHNA IYER (New Delhi) : *Some Distributions arising from Markov Chains.*

For a random sequence of n observations in which $a, b, c, \dots$ occur with probabilities $p_a, p_b, p_c, \dots$ the author has discussed the distributions and the cumulants of the number of transitions like $aa, ab, ac, \dots, ba, bb, bc, \dots, ca, cb, cc, \dots$ for successive observations. It has been also shown that the distributions and the moments for the transitional numbers when the sequence consists of $n_1, n_2, n_3, \dots, a, s, b, s, c$'s $\dots$ can be obtained from the one mentioned above by making the simple substitution,

$$p_a^p p_b^s p_c^t = \frac{[p] [s] [t]}{n [p+s+t+\dots]}$$

in the corresponding distributions and moments about the origin. Similar distributions for Markov chains have been considered by Bartlett, Whittle, Dawson and Good, Goodman and others. Bartlett has shown that the asymptotic distribution of the transitional numbers is normal and that the cumulants are obtained from cumulant generating function

$$K_n(\theta) = n \log \mu(\theta) \quad \dots \dots \dots (1)$$

where $[\mu(\theta)]_{\theta=0} = \lambda_{\theta=0} = 1$. λ is the dominant root of the determinantal equation $|\lambda I - p_{ij}| = 0$ $\dots \dots \dots (2)$

and p_{ij} are the transitional probabilities.

The cumulants & product cumulants of these distributions have been evaluated from equation (1) when the number of states in the sequence is only two. When there are more number of states it has not been possible to get the cumulants. Whittle has discussed these distributions and has derived the approximate low order moments. Dawson and Good, and Goodman extended these results for Markov chains of higher orders. Goodman has succeeded in obtaining the exact distributions for cases where the Markovity is not negligible. In this paper we give a procedure by which the distribution of the number of transitions for a Markov chain can be obtained from the contingency table showing the various first order transitions. The results are extended for transitions of second orders as well. We have also obtained the probability generating functions for conditioned and unconditioned distributions for a chain represented by the matrix (p_{ij}) . The distributions considered include (a) different states (b) first order transitions and (c) first and second order transitions. The cumulants of some of these distributions for finite and asymptotic cases have been worked out from the generating functions.

5. DR. K. S. RAO (New Delhi) : *Multivariate Stochastic Process.*

The need for a study of multivariate stochastic process arises in statistical inference in relation to dynamic economic models of the type

$$Y = AZ + X \quad \dots \dots \dots (1)$$

where Y is a k -variate vector studied in terms of the variable matrix Z , A is the matrix of parameters in the behaviouristic equations and X is the residual vector.

2. *The periodogram of a multivariate stochastic process.*

$$\text{If } U_1, U_2, \dots, U_n \quad \dots \dots \dots (2)$$

is the representation of a k -variate stochastic process, then we define the matrices

$A \left(\frac{a}{n} \right)$ and $B \left(\frac{a}{n} \right)$ by

$$A \left(\frac{a}{n} \right) = \frac{2}{n} \sum_{t=1}^n U_t \cos 2\pi \frac{a}{n} t \quad \dots \dots \dots (3)$$

$$B \left(\frac{a}{n} \right) = \frac{2}{n} \sum_{t=1}^n U_t \sin 2\pi \frac{a}{n} t \quad \dots \dots \dots (4)$$

We define the periodogram of the time-series (2) by the matrix

$$I \left(\frac{a}{n} \right) = A \left(\frac{a}{n} \right) A' \left(\frac{a}{n} \right) + B \left(\frac{a}{n} \right) B' \left(\frac{a}{n} \right) \quad \dots \dots \dots (5)$$

If
$$P_p = \sum_{t=1}^n U_t U'_t \quad \dots \dots \dots (6)$$

$$2P_s = \sum_{t=1}^{n-s} \left(U_t U'_{t+s} + U_{t+s} U'_t \right) \dots \dots \dots (7)$$

then we have the identity

$$I \left(\frac{a}{n} \right) = \frac{H}{n^2} \left\{ P_0 + 2 \sum_{s=1}^{n-1} P_s \cos 2\pi \frac{a}{n} s \right\} \dots \dots \dots (8)$$

We shall define the process to be stationary if

$$E(U_t) = 0 \quad t = 1, 2, \dots \dots \dots (9)$$

$$E(U_t U'_t) = \Lambda = (\lambda_{ij}) \quad i, j = 1, \dots k \dots \dots \dots (10)$$

$$E(U_t U'_{t+s}) = \Lambda(s) \text{ for all } t \dots \dots \dots (11)$$

Then the expected value of the intensity of the periodogram at a/n, adjusted for n, is

$$E \left(\frac{n}{2} I \left(\frac{a}{n} \right) \right) = 2\Lambda + 4 \sum_{S=1}^{n-1} \left(1 - \frac{S}{n} \right) \Lambda(s) \cos 2\pi \frac{a}{n} s \dots \dots \dots (12)$$

Summing over all $\frac{a}{n} \leq x \leq \frac{1}{2}$ and proceeding to the limit we have the integral spectral function (after adjusting for scale) as

$$F(x) = 2xR + \frac{2}{\pi} \sum_{s=1}^{\infty} R(s) \frac{\sin 2\pi x s}{s} \dots \dots \dots (13)$$

for $0 \leq x \leq \frac{1}{2}$ and R(s) denoting the correlation matrix derived from $\Lambda(s)$ provided

$$\sum_{s=1}^n R(s) \sin 2\pi \frac{a}{n} s = 0(n) \dots \dots \dots (14)$$

Hence in case term by term differentiation of R.H.S. of (13) is justified,

$$dF(x) = \left\{ 2R + 4 \sum_{s=1}^{\infty} R(s) \cos 2\pi x s \right\} dx \dots \dots \dots (15)$$

Inverting we have

$$R(r) = \int_0^{1/2} \cos 2\pi x r dF(x) \dots \dots \dots (16)$$

Hence the necessary and sufficient condition that

$$R(r) = 0 \text{ for } r = 1, 2, \dots \dots \dots (17)$$

is that

$$dF(x) = 2 R dx \dots \dots \dots (18)$$

That is

$$F \left\{ \frac{n}{2} I \left(\frac{a}{n} \right) \right\} \dots \dots \dots (19)$$

is the same for all a in $1 \leq a \leq \frac{n}{2}$

In fact we should have

$$E \left\{ \frac{n}{2} A \left(\frac{a}{n} \right) A' \left(\frac{b}{n} \right) \right\} = E \left\{ \frac{n}{2} B \left(\frac{a}{n} \right) B' \left(\frac{b}{n} \right) \right\} = E \left\{ \frac{n}{2} A \left(\frac{a}{n} \right) A' \left(\frac{b}{n} \right) \right\} \quad . \quad (20)$$

for all $1 < a, b \leq \frac{n-1}{2}$; $a \neq b$

It can be shown that there can be more than one type of stochastic process with the same spectral function.

In case $U_1, U_2, \dots, U_n$

is the representation of a process with independent variates having the same dispersion matrices but possibly unequal means, then also we do not have

$$E \left\{ \frac{n}{2} A \left(\frac{a}{n} \right) A' \left(\frac{a}{n} \right) \right\}, E \left\{ \frac{n}{2} B \left(\frac{a}{n} \right) B' \left(\frac{a}{n} \right) \right\}$$

the same for all a in $1 \leq a \leq \frac{n-1}{2}$. Hence a test for the hypotheses is that they

are the same provides for testing either type of hypothesis against its alternatives. The same test procedure will test either type of null hypothesis against its alternatives is suggested by the fact that the same spectral function can correspond to several types of stochastic processes previously established by the author.

6. DR. N. U. PRABHU (Dharwar) : *Stochastic Processes occurring in Storage Theory.*

An inventory (or storage) is an amount of material stored for the purpose of future sale or production. The inventory function $Z(t)$ is defined for discrete time $t=0, 1, 2, \dots$ by the recurrence relation

$$Z(t+1) = Z(t) + X(t) - Y(t),$$

where $Y(t)$ (the output) is the amount sold at time $t+1$, and $X(t)$ (the 'input') is the amount ordered at time t in accordance with a certain ordering policy. Further if $Z(t)$ denotes the demand for the material at time t , it is assumed that $Z(t)$ is a random variable; the output is then a function of this demand and the input. Models of this type occur in economics and business administration, and have received considerable attention during the last few years.

There are also situations in which the input (for instance, the yield of grain) is a random variable, while the demand is assumed to be known, and is met according to a specified storage policy. Thus a dam is an inventory of this type: here $X(t)$ represents a random input of water into the dam, and the demand is either for water to be supplied to a city or for generating electric power. We might then be interested in studying the situation under conditions of statistical equilibrium or calculating the probability that the dam with a given initial content will run dry within a given time period. Moran gave a probabilistic formulation of the model in 1954, which was followed by further work by Moran, Gani and Prabhu.

In the basic model considered by Moran the time variable is discrete, which is not very realistic. Gani and Prabhu (1958, 1959, 1960) have extended it to the continuous case where $X(t)$ is a temporally homogenous additive process. The release is continuous and occurs at a unit rate except when the dam is empty and the dam is of infinite capacity. The storage function $Z(t)$ is in this case a

temporally homogenous Markov process; this process has been studied by Gam and Prabhu in the case of a Poisson input and also in the case of a continuous infinitely divisible input of the Poisson type.

The problem of economical use of reservoir water is of great practical importance to our country, and it is necessary to have an optimum storage policy to make the best use of scarce resources.

7. SHRI C. MOHAN : *Some Problems in the Statistical Theory of Random Walk.*

The talk is divided into two parts. Part 1 consists of a brief review of the Statistical theory of Random Walk. In part 2 some of the results arrived at by the author in connection with the investigation, Correlated success runs, are derived.

Part 1

To start with the classical random walk and related problems are discussed. Most of the results are classical but an attempt is made to present a unified treatment.

A brief account of some of the important contributions to the theory by such authors as Kendall, Kac, Daniels and Gillis is then added so as to mention some of the more recent achievements.

Part 2

This part deals with the generalisation of the Classical Success runs problem. To start with the generating function of the recurrence times of the correlated success runs is obtained and it is indicated that such runs are certain recurrent events. An approximation to the probability that the first run occurs at the n th trial is then obtained.

8. DR. T. V. AVADHANI (Waltair) :

The main idea of Prof. Nagabhushanam's paper was clarified as follows :

Cramer's representation of a Stationary Stochastic Process and Karhunen's generalisation for any process can be exploited to solve : (a) Stochastic Differential equations and (b) Stochastic Integral equations. This method was not employed before to solve such equations.

This was illustrated by taking a stationary process as an example in each case.

I would like to mention one important application of Stochastic Process not touched upon in this symposium, but requiring thought. It is the new approach to Quality Control Charts, suggested by Prof. Barnard in his recent article in J.R.S.S., Vol. 21, No. 2. This field appears to be full of promise.

Units sampled from a production process for inspection can be viewed as truncated realisations of a Stochastic Process. Quality Control Charts and inspection Sampling procedures can be examined from this angle.

9. DR. K. NAGABHUSHANAM (Waltair) : *Stochastic Processes and Stochastic Differential and Integral Equations.*

Whenever a phenomenon unfolds over time or space, subject to some laws of probability, we call it a Stochastic Process. Observations may be made at discrete time points or continuously over time. In both cases we get a sample in infinite

dimensions. Probability measures in such spaces can be defined. A single observation is an infinite sequence in the discrete case, and a function in the continuous case. Thus the collection of such sequences or functions will be the population for consideration. The process is sometimes referred to as "Random Function".

Apart from considering a process as a collection of sequences or functions, it can be regarded also as a collection of complex-valued random variables (X_t) , where the index t is a real variate, discrete or continuous.

We now define a spectral process.

Let W be a set of elements (λ) , and $Z(S)$ be a random set function defined on subsets (S) of W . Without loss of generality we assume that

$$E(Z(S)) = 0,$$

Let $\sigma(S)$ be a finite measure defined on W . If $Z(S_1) + Z(S_2) = Z(S_1 + S_2)$ whenever S_1 and S_2 are disjoint, and if

$$E(Z(S_1) \overline{Z(S_2)}) = \sigma(S_1 - S_2)$$

$Z(S)$ is called a "Spectral Process" or an "Orthogonal Process".

For such a process we can define

$$\int_W f(\lambda) dZ(\lambda)$$

provided $f(\lambda)$ is a complex-valued function, such that

$$\int_W |f(\lambda)|^2 d\sigma(\lambda) \text{ is bounded.}$$

The following important theorem was proved by Karhunan.

If X_t is a process of zero mean, and if the covariance function $R(t, u) = E(X_t \overline{X_u})$ has the representation $\int_W f(t, \lambda) \overline{f(u, \lambda)} d\sigma(\lambda)$, then there exists a spectral

process $Z(S)$ such that

$$X_t = \int_W f(t, \lambda) dz(\lambda)$$

From Khintchine's theorem that a correlation function $R(t)$ can be expressed

as $R(t) = \int_{-\infty}^{\infty} e^{it\lambda} d\sigma(\lambda)$ we get the Cramer representation of a stationary stochastic

process

$$x(t) = \int_{-\infty}^{\infty} e^{it\lambda} dz(\lambda)$$

Generally a process is analysed with the help of difference or differential equations which the probabilities satisfy. But in some cases the analysis is carried out by means of equations involving directly the process variates themselves.

Thus if X_t is a continuous process, then $\frac{dX_t}{dt}$ can be defined as $\lim_{h \rightarrow 0} \frac{X_{t+h} - X_t}{h}$

We now consider the stochastic differential equation

$$\frac{d^2 X_t}{dt^2} - X_t = \xi_t$$

Where the ξ -process is stationary and X_t is unknown, using Cramer's representation and multiplying both sides by $-\frac{1}{2} e^{-\frac{1}{2}|u|}$ and integrating w.r. to u from $-\infty$ to

∞ , we get $X_t = -\frac{1}{2} \int_{-\infty}^{\infty} \xi_{t-u} e^{-\frac{1}{2}|u|} du$. Similarly stochastic integral equations can be

solved by these methods.

10. DR. K. C. CHANDA (Bombay) : *Modifications of large sample tests of goodness of fit for Linear Autoregressive Scheme with applications to small samples.*

Mathematical Statisticians while investigating the nature of time series, generally assume either the normality of the primary distributions or that the time series are long. This is necessary to enable the Statisticians to make any useful statement about the inherent properties of the time series under enquiry. If the series is assumed to be free from trend (complications arise when trend is present in which case one has to adopt methods for estimating the trend and making the time series trend free) and completely stationary then the two main problems which have engaged the attention of the statisticians so far are (1) to determine whether the series is autoregressive (a.r.), moving average (m.a.) or oscillatory, composed of several harmonics or a mixture of any or all of them and (2) if the series is any one of them in the pure form then to determine the 'Order' of the series. We shall be concerned here with the second problem with particular reference to a.r. series.

Rudra, Quenouille, Bartlett-Diananda and Whittle have developed methods for discriminating the order of the process, when the time series is long. Econometricians are not very happy at this large sample approach because the time series they have to investigate are not more than moderately long so that the usual large sample approximations are not valid. As a substitute they have introduced the idea of circularity which together with the assumption of normality have partially been able to resolve the difficulty of deriving the exact sampling distributions of the test criteria.

The author has suggested a slightly different approach. This consists in deriving more accurate approximations to the sampling distributions of the test criteria suggested by Quenouille, Bartlett-Diananda and Whittle. The method used is the asymptotic expansions of the sampling distribution as an Edgeworth series to a pre-assigned order $n^{-\frac{1}{2}u}$ ($u \geq 1$). The author intends to investigate further along this line and will announce the results shortly.

II. STATUS OF EXPERIMENTAL DESIGN IN RESEARCH

(Jointly with the Sections of Agricultural Sciences, Medical & Veterinary Sciences and Engineering & Metallurgy)

Chairman : DR. G. R. SETH, New Delhi.

INTRODUCTION.

The principles underlying the modern theory of design of experiments were evolved mainly for agriculture but their utility has since been recognised by re-

search workers in other branches of science also, wherever observations are subject to large uncontrollable errors. These principles ensure on the one hand the validity of the conclusions drawn and increase the accuracy on the other. To draw inferences from observations collected without regard to the principles of designs has been found to be risky in various circumstances and many investigations carried without consideration for the design aspect have to be abandoned because no valid statistical inferences are possible.

The problems that a proper design is to solve are different in different fields and depend upon the specific nature of the factors involved and designs which are suitable in a field may not be so in another field. Some designs like the latin square and randomised blocks originally evolved in agricultural experiments were found suitable in industrial field also but recently designs have been evolved to suit conditions of industrial experiments, where among other things the number of factors involved is often much more than in agriculture. I think for really fruitful work, there should be a greater degree of collaboration between mathematical statisticians and research workers in other fields to evolve designs specifically suited to these fields. I hope the present discussions will throw some light on various aspects of design of experiments.

1. DR. V. G. PANSE (New Delhi) : *"Extension of agronomic experiments in cultivator's fields"*.

Observational surveys and controlled experimentation are a major empirical source of new knowledge in biological as well as physical sciences and in applied as also pure fields. Knowledge of causation can be derived strictly from controlled experimentation alone. Where both methods of obtaining data can be combined, knowledge of great practical as well as of fundamental value can be secured, as has been done in the large scale programme of fertilizer trials in progress in the country.

Experimental design includes choice of treatments and manner of their application, choice of experimental units to which the treatments are to be applied and choice of measurements to represent the effect of treatments. How far the experiment meets with the objectives of the investigation and supplies the experimenter the knowledge that he seeks depends on these matters. If the objective is to obtain guidance for making practical decisions as in an industrial plant, the range of treatments to be tried will be more restricted than if fundamental information is sought. Even so, practical decisions can be strengthened by a somewhat wider range of treatments than is considered strictly germane to the problem. The choice of experimental units, such as plots of land, rats, samples of raw materials or items of manufactured products, has to be guided by two opposing considerations. One is greater degree of homogeneity to ensure more precise results and the other working over the normal range of variability to widen the applicability of results. Use of highly inbred plant and animal material satisfies the first criterion, but the general applicability of the results to common plants and animals is doubtful. Measurements to be recorded present a problem where the nature of treatment effects is not clear as when studying the control of incidence of and damage from pests and diseases. Choice of suitable ancillary measurements to improve precision of the results is also important. The other two factors determining the precision of results are the size of experiments and use of devices to control heterogeneity of experimental material.

The choice of experimental design must obviously be appropriate to the nature of the research problem and the conditions under which the experiment is to be performed. Large factorial experiments with confounding are feasible at agricultural research stations, but the nature of confounding has to be altered when

experiments are projected on a sample of farmers' land. In industrial plants, where a number of small experiments can be carried out one after another rapidly, factorial experiments may be designed in a sequential manner, varying one factor at a time. Details of a large-scale programme of fertilizer experiments being conducted by the Indian Council of Agricultural Research are discussed as an illustration of experimental design.

2. DR. K. KISHEN (Lucknow) : *Recent research in design of experiments for meeting the needs of experimenters in various sciences.*

Originated by R. A. Fisher at Rothamsted for providing an efficient tool for experimental investigation, the theory of design of experiments is now playing an increasingly important role in research in various branches of science, notably in the agricultural, biological, industrial, chemical, physical and engineering sciences. In fact, the needs of research workers in these fields have greatly stimulated research in recent years in the theory of design of experiments with a view to providing them with the most appropriate designs which would ensure optimum utilization of the available experimental resources.

Recent research in the design of experiments has been directed to the construction and analysis of fractional factorials and incomplete factorials which ensure considerable economy in the use of experimental resources when a large number of factors are required to be tested. These designs were first introduced by Plackett and Burman and were called by them "Optimum multifactorial experiments". Subsequently, these were generalised by Rao in his hypercubes and orthogonal arrays of strength 't'. The problem of constructing incomplete factorials was then successfully tackled from a fundamentally new angle by Box and his co-workers by developing their multifactor experimental designs for exploring response surfaces. These designs are of particular value in physical, industrial and chemical research where the optimum combination of physical conditions such as temperature, pressure, amounts and concentrations of various ingredients, etc., that gives the maximum yield or net return from some product, is to be determined.

A sequential method of experimentation is another important development in the theory of design of experiments. This method has been found to be of particular value in medical research when it is desired to compare the therapeutic effect of a new drug against a standard one. Bross has shown that the number of patients required under sequential experimentation is about half of that required for arriving at conclusions with equal certainty when the number of patients is chosen in advance. A similar procedure for discriminating between the genotypes has been suggested by Fisher. Another useful device, based on the sequential procedure, is the "up and down" or staircase method developed by Dixon and Mood for determination of the median lethal dose in biological assays.

Reference may also be made to the remarkable advance made recently by Bose, Shrikhande and Parker in demonstrating the complete falsity of Euler's conjecture and providing that two mutually orthogonal Latin squares of side $4t+2$ ($t \geq 2$) exist, which will have important repercussions on the future development of experimental design.

It would thus be seen that a significant trend in recent research in experimental design is the evolution of special types of designs which bring about the maximum reduction in the amount of work required to be done in an experimental investigation. Experimental design has thus become a powerful tool for research workers in the various sciences in the investigation of their problems. Much, however, still remains to be done in perfecting the theory of design of experiments. Research in the theory is, therefore, rightly being pursued with

vigour and we can look forward to the introduction of further fundamental concepts in this theory as increasingly complex problems in scientific research present themselves for solution.

3. SHRI M. N. DAS (New Delhi) : *On experimenters' need and incomplete block designs with special reference to biological assays.*

The existing designs of experiments have one common drawback that they do not have much flexibility in meeting the diverse requirements of the experimenters in different fields. Designs have so far been evolved keeping in view the estimation of particular types of comparisons and their precision. Thus, we have the balanced incomplete block designs which have been evolved so as to estimate the difference between any two treatments with equal precision. These designs thus meet the requirements of those experimenters who are interested equally in all contrasts between pairs of treatments. We have another type of experiments where the interest lies in the contrasts of groups of treatments, the groups being so chosen that they represent what are known as main effects and interactions of different factors. Efforts have been made to evolve another series of designs called confounded factorial designs whereby some contrasts can be kept free from block effects, while others are partly or wholly affected by them. Recently one more type of designs called design for the study of response surfaces have been evolved. These designs are the product of research to meet the need of estimating the response surface efficiently by means of which the point of optimum response can be obtained without any relatively more loss of information. Here the interest shifts from comparisons to estimation and optimum designs necessary for them are thus different.

In biological assays where the main purpose is to compare two or more preparations of a drug or some other stimulus, the main problem is to find out a dose from each of the preparations producing the same response. In such assays involving only two preparations it becomes necessary to adopt incomplete block designs through which two particular contrasts among the doses of the preparations are to be estimated with the optimum precision. These two contrasts are (i) the difference between the totals of dose effects; and (ii) combined slope of the two linear regressions of the response on the doses for the two preparations. The existing designs are not optimum for this purpose.

There is thus a necessity of introducing the need factor while evolving designs. We have attempted to find out criteria for increasing the flexibility of the designs by introducing the need factor and have been able to obtain through them a series of designs particularly suitable for bio-assays.

4. SHRI T. P. ABRAHAM (New Delhi) : *Status of Experimental Design in Agricultural Research.*

Statistical techniques in experimental research developed by Fisher, Yates and their associates made a profound influence on agricultural research in India in the last three decades. A fairly good idea of the status of experimentation in recent times in this country could be obtained from an examination of the experimental data collected by the I.C.A.R. under a scheme known as the National Index of Field Experimentation. A complete list of agricultural field experiments other than purely varietal trials is now available in the Council for the period 1948-53. During this period details of about 8000 field experiments have been conducted at the different research stations in the country. A thorough examination of these experiments in respect of the nature of the treatments studied, the crops involved, the designs adopted, the accuracy obtained, etc., has been made.

Experiments in cultivators' own fields by adopting suitable designs is another significant advance due to the Institute made in recent times. The verification and demonstration of results of research obtained at experimental stations on farmers' own lands and under their conditions of cultivation is an essential step in persuading them to adopt the use of improved techniques of agriculture.

While considerable advance has been made in the use of modern experimental designs in agronomic research, its use has not progressed to the same extent in some fields such as entomology, mycology, and horticulture. The limited number of trees available for experimentation, the long productive life of a tree and the large inherent biological variation among trees are all factors which necessitates considerable thought in the planning and analysis of such experiments. The Institute of Agricultural Research Statistics has initiated some work in this direction on a few crops like coconut, mango, arecanut and citrus.

Experimentation on pests and diseases also presents numerous problems particularly of sampling for estimation of insect population or intensity of disease or pest incidence. The Plant Pathologist and Entomologist need to be assisted a great deal more in the planning of their field experiments by suitable modifications of the experimental designs and sampling techniques which have been largely developed in connection with agronomic research.

5. DR. B. D. TIKKIWAL (Dharwar) : *Some recent developments in analysis of variance and their impact on research.*

The technique of analysis of variance was developed by R. A. Fisher in connection with the field experiments in agriculture. Subsequently this technique was extensively used in designs of experiments. In 1947 Eisenhart enumerated the assumptions underlying the analysis of variance under two postulates : Model I and Model II. In Model I it is assumed that the various effects are additive and the experimental errors alone are normally independently distributed with a zero mean and a constant variance. There have been, however, situations with significant departure from the various assumptions. This calls for caution in using the technique of analysis of variance.

The effect of departure from normality assumptions has been extensively investigated by Hey. From a study of Hey's and others' results Cochran has concluded that the effect of non-normality is in the direction of announcing too many significant results.

The effect of heterogeneity of variances and correlated errors has been investigated by Box. He has concluded that the effect of heterogeneity of variances is not so serious as that of correlated errors.

The method of examining heterogeneity of variances and of correlated errors in n -way classification has been given by Bhat. The present author was associated with this work. Though these methods were developed for the purpose of examining the effects of heterogeneity of variances and of correlated errors, they can also be used in obtaining various other classical results concerning analysis of variance.

6. SHRI V. N. AMBLIE (New Delhi) : *Status of Experimental Design in Animal Research.*

The application of modern experimental designs is not as advanced in the field of animal experimentation as in agriculture. The simplest designs like completely randomised designs, randomised block designs and less frequently the latin square designs are generally used for such experimentation. The switch over as also the cross over designs are particularly suited to certain types of animal experimentation.

Through this design animal to animal variation can be eliminated by testing each of the treatments in turn on every experimental animal. These designs permit also separate estimation of direct and residual effects of the treatments provided the residual effects last only for the duration of a single period and that there is no interaction between residual and direct effects. There is a possibility in these designs of the treatment differences being confounded with the interaction between the sets of animals allotted to different sequences of treatments and the periods. This can be taken care of by grouping animals having equal persistency to form blocks before their random allocation to different sequences of treatments. Though the switch over designs are extremely efficient when residual effects are known to be absent, their use require care in situations in which the treatments are slow in effect and are likely to have residual effects.

Complex designs like confounded factorials and incomplete block designs have rarely been employed in this field. In New Zealand the use of partially balanced incomplete block designs in two plot blocks for experiments with cattle twins has been reported. A further feature of animal experiments is that animal data very often turn to be non-orthogonal and require rigorous treatment. In certain cases such as in experiments with un-sexed chicks non-orthogonality of data is unavoidable.

A recent study carried out at the I.A.R.S. on the relative efficiency of these designs using the data on some of the herds of cattle maintained at Government Livestock Farms showed that for experiments on dairy cows use of order of lactation for the formation of blocks resulted in a gain in efficiency of the order of 50 per cent whereas the season of calving was not a useful criterion for forming blocks. The use of a latin square design using both the criteria did not improve the efficiency materially. On the other hand the use of previous lactation yield as a concomitant variate reduced the error further. Switchover design proved to be extremely efficient, the gain in efficiency ranging from 113 to 803 per cent. The formation of blocks in switchover trial resulted in a further gain in efficiency.

7. PROF. S. K. EKAMBARAM (Mysore) : *Role of Design of experiments in industry.*

In Industrial applications of statistical methods, the spearhead is the statistical quality control. It is essential that the approach and terminology of S.Q.C. is maintained and elaborated to deal with the experimentation problems (which are many) in Industry.

The splitting of the observational material into rational sub-groups, and the study of the factors involved may be the appropriate approach in many cases for using, in Industry, the theory and results of Design of Experiments. Though there is a place for carefully designed experiments to be performed in Industry, the field is far more wide for "survey" type of design, where the factory working will not be too much interfered with during the collection, analysis and interpretation of the experimental results. The planning of Industrial experiments should bear this angle in mind.

At the stage, where pilot runs are made to check and decide on the future programme and organisation of production, the factorial designs and sequential designs would serve the purpose well in appropriate cases and would be economical in money and time. The approach should be from the S.Q.C. terminology in terms of standards, tolerances and assignable causes.

In sampling inspection, standard procedures have been evolved for single, double, multiple and sequential sampling from lots and continuous productions. In situations where formation of homogenous lots is difficult, suitable designs may be tried to keep a check on *homogeneity within*, while attempting to compare differences between lots.

Whatever experimental design is used, the technician concerned should be asked to comprehend the implications and nature of the inferences arrived. The statistician and the technician should work in full cooperation to avoid pitfalls. Judgment and logic should both be utilised in planning and interpreting designs of experiments. This is essential, as it is in other fields of applications of statistical methods.

8. SHRI V. J. CHACKO :

I wish to indicate only a few examples of the type of problems in forestry. In agricultural field experiments dealing with annual crops only one observation namely the yield at the time of harvest is of interest. Forestry field experiments mostly are long term in character extending over a large number of years and observations are recorded for a number of dates. Thus the observations will consist of a series of growth curves. What is of interest then is to study the rates of growth corresponding to the different treatments. This study is particularly involved since the growth curves are usually of the sigmoid type. Being long term experiments there is all the more need for proper designs in forestry experiments.

In Timber Engineering the problem may be to find out the optimum number and spacing of nails in a joint made from pieces of wood. Here the results of uniformity trials on strength properties and the variability between different specimens of the same species will have to be kept in mind for a proper design.

Consider an experiment in soil conservation where the treatments are different patterns of terraces on sloping ground. Here if fresh randomisation of the treatments is proposed every year, it will lead to great trouble and inconvenience and probably non-comparability also.

9. SHRI N. SEN (Lucknow) :

Medical experiments as distinct from agricultural experiments have to be simple for following reasons :

(1) Formation blocks is difficult. Initially measurable vectors on which blocks are formed does not necessarily decrease the variance of physiological responses or organ weights.

(2) Interested only in specific comparisons rather than over all comparison which is implied in the use of analysis of variance of complex designs.

(3) Missing observations is very common, which makes the design non-orthogonal.

It may be advantageous to use litter marks, to group the animals according to age or weight etc., but the availability of sufficient number of litters with specific number of males or females etc. is a common problem.

Thus in planning medical experiments attention has to be given to (a) Level of measurement, (b) Randomization, (c) Special techniques like : Counting techniques, dilution methods, bio-assay, use of truncated data etc.

The traditional method of experimentation in biological field is to have the groups as similar as possible in all respects except in the one variable factor under investigation. This over specification of the conditions of experiment is one of the reasons why the conclusions drawn from a biological experiments are often contradicted. Actually we should have distinct groups with maximum homogeneity within group, and treatment comparison should be made within group.

Too much emphasis is given to significance of difference of means. It is useful in pilot and screening experiments, but more emphasis should be given to estimation of difference and casual factors for the high C.V. of responses in treated groups.

A few fallacies in planning of biological experiments have been considered.

A few remarks regarding analysis :

(i) Parametric methods are often being applied irrespective of level of measurement; methods valid for normal data are often being applied to non-normal data. Some studies relating to the nature of distribution and correlation between different type of bio-chemical and physiological measurements of experimental animals will be of great help to Statisticians.

(ii) Adequacy of some common adjustments like use of : relative organ weight, percentage change in blood pressure, increase in body weight, decrease in blood sugar instead of organ weight, final blood pressure, final weight, final blood sugar respectively to increase precision of comparisons needs examination. Experience shows that such adjustments quite often results in increase of C.V.

In biological fields we decide in favour or against a hypothesis on the basis of a small sample. So it is all the more necessary to use a well planned experiment which can give unprejudiced answer to the question asked. The statistician guards against bias in planning and drawing conclusions. Therefore he should not be asked to advice at the conclusion of the experiment but should be consulted at the beginning to participate in formulating the experimental procedure, since the experimental plan and designs are just as important from a statistical view point as the final analysis.

10. DR. R. F. FARQUHARSON also participated in the discussion.

11. PROF. CHINOY :

All biological experiments are based on the law of limiting factors. During the early stages of agricultural experimentation it was assumed that each of the contributing factor had an independent action of its own on the process under study. R. A. Fisher corrected this erroneous concept and pointed out that the factors governing a biological process are not independent but interdependent and laid the foundation of complex factorial field experiments, where over and above the effect of different factors at varying levels their interactions can also be studied.

In working out experimental designs it is also essential to take into consideration the physiological effects of different factors and their interactions so that experiments not only balanced statistically but also what is more important biologically sound may be laid out. Many of the agronomical experiments carried out at various research stations and institutions in India suffer from this defect. Numerous instances in published work as well as in the records of various research stations can be cited in which different levels of watering have been studied without taking into consideration the nutritional level of the soil or in others where various nutritional levels are studied without taking into consideration the moisture level of the soil. Similarly sowing time experiments have been done without studying the effect of spacing.

Another important aspect of the agronomic experiment is the technique of growth analysis developed by Professor F. G. Gregory and his collaborators. This technique has been very successfully applied in progressive countries in order to obtain further elucidation of factors affecting growth and yield of a crop plant. The outstanding results of Cotton Physiological Scheme sponsored by the I.C.C.C. some years back under the guidance of Professor R. H. Dastur at Lyallpur (in undivided India) is a very good example of what can be achieved by following the proper technique.

In conclusion, therefore, one can say that :

(a) The statistician who is not conversant with the physiological effects of interactions should not undertake to design an experiment unless he receives the active collaboration of a worker in plant science.

(b) A course of statistical analysis and growth analysis should be made compulsory for all workers in biological sciences.

12. DR. K. R. NAIR (New Delhi) : *Experimental Design in Forest Research.*

The publication of the Experimental Manual as Vol. I of "Silvicultural Research Manual for use in India" by H. G. Champion marked the starting point in standardizing methods of experimental research in Indian forestry. The importance of statistical methods of design and analysis of silvicultural experiments received recognition at the hands of the author of the manual by the inclusion of a separate chapter on 'Statistical Methods' and by various advices of a statistical nature to forest research workers all through the books. Subsequently in recognition of the great developments that had taken place in statistical science since Champion, the Forest Research Institute published in 1947 a 'Statistical Manual' as Vol. 2 of the revised Silviculture Research Code.

The problems in forestry are more difficult than in agriculture because more extensive areas are involved, initial comparability between plots is difficult and the time for a treatment to manifest itself is much longer than in the case of agricultural crops. On account of these the experiments in forestry should be planned correctly. In earlier days of forest research the essential precautions like initial comparability, replications, etc., were inadequate. At present the workers have realised the importance of these precautions so that the experiments are being conducted now-a-days on a more logical basis.

International organisations are now giving due importance to the role of experimental design and statistical methods in forest research. From a suggestion by the author the F.A.O. in cooperation with the Government of India organised in 1955 a two months' seminar for various research workers of the Asia Pacific region. The seminar dealt with primarily with the application of statistical methods in forest research. More recently an advisory group of various statisticians with Dr. K. R. Nair as chairman was set up. It is hoped that the formation of this advisory group will help to bridge the gap between statisticians' doctrines and the research workers' practice.

From a brief review of the recent developments in the theory of experimental designs it would be seen that it is the needs of the experimenter in the biological, physical, chemical and other sciences which have stimulated and inspired statisticians to make contributions. The most fruitful results have emerged from a close collaboration between statisticians and the experimenters and in this respect the contribution from forest research is not inconsiderable.

I. INSTRUMENTATION IN NUCLEAR PHYSICS

Section of Physics

Chairman : DR. R. RAMANNA, (Trombay), Bombay.

1. R. RAMANNA (Trombay) Bombay : *A. Scintillation-Ionisation Chamber for the study of the Angular Distribution of Fission Fragments.*

A gaseous scintillation counter in conjunction with an ionisation chamber has been developed to determine the angle of the ionising particles with respect to a fixed direction. This has been used to study the characteristics of the fission process in respect of the angular correlation of prompt neutrons and fission fragments. This system has been developed by R. Chaudary, S. S. Kapoor, S. R. S. Murthy,

R. Ramanna and P. N. Rama Rao. The method consists in observing the fission fragments from a thin layer of Uranium-235 irradiated by thermal neutrons from the *Apsara* reactor. The layer of Uranium-235 is coated on the cathode of a gridded ionisation chamber filled with Xenon gas. This filling serves the double purpose of providing a gas for ionisation and scintillation. A photo-multiplier incorporated in the chamber observes the light emitted along the fission fragment track due to scintillations in the Xenon gas. The Xenon gas is filled after a high degree of purification. The fission scintillation pulse gives the zero time and the subsequent rise of the fission ionisation pulse from the gridded ionisation chamber gives the measure of the projection of the fission track on the electric field. From the pulse height of the fission fragment as given in the ionisation chamber, the range of the track can be computed. From the knowledge of the projection of the range along the fixed direction, the angle of the fission fragment track is determined along the direction of the electric field of the ionisation chamber. At a distance of 1 metre is placed a fast neutron plastic scintillation counter to detect the prompt neutrons from the fission process. The energy of the prompt neutrons is computed by the time of flight which is equal to the time-difference between the fission scintillation pulse and the neutron scintillation pulse. The characteristics of such a system are described. The results on the angular correlation of the prompt neutrons and the fission fragments in the study of fission of Uranium 235 are discussed.

2. C. H. PAREKH (Trombay) Bombay : *Gas flow counter using a complex hydrocarbon mixture.*

The use of 'Burshane' which is a domestic fuel marketed by Burmah Shell Refinery in Bombay, as a medium for α detection in gas flow counters has been investigated. Results obtained using a polonium source indicate that Burshane can be used as a substitute for the comparatively costlier gases used in gas flow counters such as argon and chemically pure methane. The Plateau characteristics of counting rate with various detecting media were studied. The threshold of plateau in Burshane was found lower than chemically pure methane. Further investigations were made with Burshane only. The integral bias-pulse-height distribution curve indicated no drop in counting rate up to 25 Volts. The absence of spurious pulses was ensured by applying χ^2 (Chi-square) test. The study of the pulse shape characteristic was made by the oscilloscopic method. The pulse photograph indicates rise time of the order of 1.75μ sec. and width at the half-height of the order of 4μ sec. Small variations in (1) percentage composition of Burshane and (2) the flow rate do not effect the counting rate. The gas multiplication was seen to increase exponentially with anode voltage upto the order of ten. A further study shows that the gas multiplication departs from exponential rise.

The gas has been tried also for the detection of soft beta particles from C^{14} and S^{35} and was found satisfactory.

LOW-LEVEL COUNTING

3. V. S. BHATNAGAR, (Trombay), Bombay : *Low-level Nuclear Counting Techniques used at the AEET.*

Nuclear weapon tests carried out during the past 15 years have caused an increase in the environmental radioactivity. The radioactivity from nuclear tests occurs in trace quantities in the air, rainwater, foodstuffs and the human body. In areas away from the testing sites the identification and accurate measurement of radio-isotopes have been possible only with the use of specially designed instruments, which should be extremely sensitive and have good reproducibility.

The measurement of fallout-produced radio-isotopes is done with two types of instruments: (1) the radio-isotopes that decay by the emission of gamma-rays are identified and measured by a gamma-ray scintillation spectrometer; and (2) the isotopes that decay only by beta-emission are measured with a low-level beta counting set-up.

Low-level Scintillation Spectrometer

For the identification and quantitative estimation of trace amounts of fallout-produced gamma-ray emitting isotopes a sodium-iodide crystal coupled to a photo-multiplier is used as a detector. A reduction in background is achieved by surrounding the crystal with 1" of mercury and 3½" of lead. Using the detector assembly with a ten-channel pulse-height analyzer a further reduction in background is obtained by energy discrimination. The sensitivity of the instrument is such that it is possible to measure 10 $\mu\mu\text{C}$ of Cs-137 with 12% statistical accuracy in about 2 hours of counting.

High electronic stability of the instrument has been achieved by paying particular attention to the high voltage supply for the photo-multiplier and the linear amplifier. It is possible to keep the instrument focussed on Cs-137 peak for at least 12 hours of operation.

The instrument is being used for the measurement of Ce-144, Rh-106, Zr-95 and Cs-137 in atmospheric air, rainwater and milk.

Low-level Beta Counting

An end-window Geiger-Muller tube of diameter 1" and length 2.5" is used as a detector. The natural background counting rate of this detector is 12 counts per minute. This is due to cosmic rays and terrestrial gamma radiation. Using a 6" thick iron shield around the counter the background is reduced to 3 counts per minute. A further reduction is achieved with an anti-coincidence shield of 8 Geiger-Muller counters of 1.75" diameter and 12" long cathode. Residual background with these two shields is 0.6 counts per minute, due mostly to the contamination of the materials used for the construction of the detector and the shield.

4. L. H. FESHORI, (Trombay), Bombay: *Low Beta Activity Measurements.*

Low beta activity measurement becomes difficult on account of background radiations due to cosmic rays, natural radioactivity of surroundings and radioactive contamination in counter. For a reasonable accuracy in any measurement, the counting rate produced by the sample has to be at least a large multiple of that produced by the background radiations. The reduction of background due to external radiation has been achieved by use of mild steel castle and anti-coincidence array of cosmic ray counters. A much simpler arrangement, the cancellation technique, has been developed which dispenses with the complicated arrangement of the array of cosmic ray counters. These methods assume that the internal contamination of counter is negligible.

Reduction of Background by Anti-coincidence technique

Half the normal background of the G.M. Counter is normally due to passage of local gamma radiation and soft component of cosmic rays. This has been reduced by screening the system in a six inches thick mild steel castle. The remaining background rate is reduced by surrounding the register counter with cosmic ray counters and by using an anti-coincidence circuit to reject all counts which occur simultaneously in both sets of counters. A vertical cross-section of a

simple arrangement has been shown. A meson which passes through the register counter has to pass through cosmic ray counters. Since the cosmic ray counters are in anti-coincidence with the register counter, no count will be recorded.

A background of less than one count per minute has been achieved by this method.

Reduction of background by cancellation technique

A simple arrangement of the counters is shown. The counters are kept in a 2 inches thick radium free lead castle. Obviously, the detecting channel responds to beta-gamma activities and the cancelling channel responds only to gamma radiations. Two channels are inserted into a cancellation circuit which reads the difference between them.

This method demands selection of counters having nearly identical performance. Two selected end window counters gave an effective background of 1.1 counts per minute after cancellation. Normal background of each counter in castle was approximately 10 counts per minute. The counter having slightly more than the normal background is used in the detecting channel.

COINCIDENCE TECHNIQUE

5. S. C. PANCHOLI and N. K. SAHA (Delhi) : *On the behaviour of a fast coincidence circuit.*

In continuation to the investigations on a germination diode bridge fast coincidence circuit, we further studied its functioning with independent photo-multiplier channels and with different pulse amplitudes and pulse shapes. The resolving times obtained are :—

- (1) with direct photo-multiplier anode pulses ~ 3 nanosec. (source of radiations cobalt 60),
- (2) with direct photo-multiplier anode pulses and 5 cm. shorted RG7/U coaxial coaxial cables ~ 0.7 nanosec. using a Na-24 gamma source, and
- (3) with direct photomultiplier anode pulses and with delay line pulse shaping circuit ~ 6.4 nanosec. (The source of radiations has been a Cobalt-60 gamma source.)

6. S. K. MITRA (Bombay) : *An Automatic Spectro-coincidence Goniometer for Angular-correlation Experiments.*

An automatic spectro-coincidence goniometer has been constructed, by which data are taken automatically. In angular-correlation experiments one has to observe coincidences between two counters as a function of the angle between them. In the present arrangement, the movable counter is fixed to an arm which is driven by a motor. The arm can be set at several angular positions in the range 90° to 270° , in increments of 15° . In experiments, we note the time for a preset number of coincidences, collected at each angle. The equipment is being used with a conventional fast-slow coincidence spectrometer having a resolving time of 15 μ s. The whole operation is as follows : The channel counts are stored in IVO impulse counters and time is recorded by an IVO revolution counter. As soon as a certain pre-set number of coincidences is collected at a particular angle, all the scalers stop, the motor is actuated so that the movable counter starts moving.

In the mean-time, all the "angles" stored and the time for which the coincidence were collected are printed out. When the movable counter reaches the next angular position, the motor stops and the counting is started again. At the end, 90° and 270°, the motor current is reversed. Some results obtained with the equipment will be presented.

NUCLEAR SPECTROMETRY

7. BALDEV SAHAI and A. A. PADMANABHAM (Bombay) : *Measurement of Circular Polarisation of Gamma rays.*

A gamma ray circular polarimeter employing forward Compton scattering from the inner surface of an Arnico iron cylinder magnetised to saturation has been constructed in order to measure the sense and degree of circular polarisation of gamma rays accompanying beta decay as also the internal and external *bremstrahlung* produced by beta particles. The mean scattering angle of the analyzer is 44° and fraction of oriented electrons is about 8% at the measured flux density of 21,000 gauss. The polarimeter is being used in conjunction with a fast-slow type of coincidence scintillation spectrometer having a resolving time of 6 nano-seconds. For allowed beta-decay the correlation function is $W(\Theta\beta\gamma) = 1 \pm A (v/c) \cos(\Theta\beta\gamma)$ where A is the asymmetry coefficient. Measurement on Co^{60} (a pure GT transition) have yielded the result for $A = -0.35 \pm 0.05$ as against $A = -1/3$ predicted from theory. Some other measurements, in progress, will be reported in future. The automatisisation of the whole set up is under contemplation.

8. P. K. IYENGAR, G. VENKETARAMAN, K. USHA, N. UMAKANTHA, N. S. S. MURTHY and B. A. DASANNACHARYA (Trombay), Bombay : *Neutron Spectrometry at Trombay.*

The technique of neutron spectrometry is relatively new and provides a valuable complement to the already well-established X-ray, optical and infra-red methods of studying microscopic dynamics of solids and liquids. The essential principle is to allow mono-energetic neutrons to be scattered by the samples and observe the energy change suffered during the scattering; this is then interpreted to reveal the details of atomic motions. This paper describes the various neutron spectrometers that are in operation at the Canada-India Reactor, Trombay.

In one instrument, which is of the triple axis type, mono-energetic neutrons are selected from the reactor spectrum by Bragg reflection from (111) planes of a lead single crystal. The energy analysis is accomplished by successive Bragg reflections of the various wavelength components in the scattered beam off (111) planes of an aluminium crystal into a neutron counter. This instrument is particularly

useful for experiments involving neutrons around 1 Å and has been used for the study of lattice dynamics of iron. Counterpart to this is the rotating crystal spectrometer designed specially for cold neutron studies. In this instrument the cold neutrons are first isolated from the pile beam by passing it through a beryllium block cooled to liquid nitrogen temperature. Sharp mono-energetic bursts are then formed by Bragg reflection from (111) planes of an aluminium single crystal rotating at 8000 RPM and allowed to fall on the specimen. The scattered spectrum is analysed by recording the times of flight of the neutrons to a counter placed some distance away, in a transistorized 100 channel time-analyser. Closely resembling this is the filter chopper type spectrometer, wherein the cold beam is

produced once again with a beryllium filter, but the scattered spectrum analysed by chopping the beam with a rotating shutter and observing the time of flight distribution.

The relative merits of the various spectrometers are also discussed and the experiments planned with these instruments described.

CIRCUITRY

9. K. V. V. NAMBUDIRI and T. R. RAMAN (Trombay), Bombay : *A new type of Logarithmic Count Rate Circuit.*

Log count-rate measuring circuits for pulses find applications in the nuclear field. The present method depends on suitably modulating the area of each pulse by the instantaneous pulse-interval and averaging the pulses in an R.C. circuit, while conventional circuits depend on controlling either the pulse area or the averaging circuit resistance by the averaged output voltage. Two different circuits to realise this are discussed. Circuits have been built to cover 4 decades of count-rate with logarithmic indication to 2% accuracy.

MISCELLANEOUS

10. V. RAMA RAO and Y. VENKITACHALAM (Trombay), Bombay : *Manufacture of nuclear electronic instruments at the Atomic Energy Establishment, (Trombay), Bombay.*

The demand for using nuclear electronic instruments in a large scale arose with the creation of the Atomic Energy Commission and the expansion of the activities of the Atomic Energy Establishment, Trombay and other institutions in the country using radioactive isotopes. Imported instruments often were found to be unsatisfactory under our climatic conditions. The Electronics Division of the Atomic Energy Establishment has produced in the past few years more than 3000 instruments suited to the climatic conditions in India. This paper discusses the production procedures and problems encountered in large scale manufacture of electronic instruments.

The development and design of the instruments prior to production are carried out in the Electronics Division. The main criteria that guide the design are (a) choice of standardised components, (b) use of maximum number of Indian instruments, (c) tropicalisation and (d) easy servicing and maintenance. The economics of production, repeatability of characteristics and the factors that determine long life under various conditions of use are studied in the Development Group of the Electronics Division.

The manufacturing instructions are then prepared and the specifications of the instruments are drawn. After a pilot run of the production running tests, testing to humidity and temperature, cyclic variations and vibration testing are undertaken. The Indian components now in use are Geiger counters, plastic scintillators, mechanical and electronic hard-wares, transformers and coils, resistors and capacitors, etc.

The instruments so far produced are portable Geiger counters, regulated power supplies, binary and dekatron scalars, counting rate meters, pulse generators, single channel analysers and gamma ray spectrometers.

II. ATMOSPHERICS AND RADIO NOISE

Chairman : PROF S. R. KHAISTGIR.

Atmospherics and Radio Noise

1. B. A. P. TANTRY (Banaras), R. S. SRIVASTAVA (Banaras) and S. R. KHAISTGIR (Calcutta) : *On Cloud-to-cloud discharges.*

In the oscillographic records of the wave-forms of the electric field changes due to cloud-to-cloud discharges obtained for the first time by Schonland *et al* (1938), there has been no evidence of return stroke pulses. In some of the wave-forms of atmospherics recorded by Lutkin (1940), the small isolated pulses of three half-cycles, separated by very short quiet intervals, were just what would be expected from discharges within the cloud, each discharge having a discontinuity in the current pulse. According to Pierce (1955), the cloud-to-cloud discharges do not show return stroke pulses.

From a large number of oscillographic records taken at Banaras during 1952-55 with the automatic atmospherics recorder, evidence was obtained of return stroke pulses in the wave-forms which were attributed to cloud-to-cloud discharges. Oscillographic evidence was also obtained in support of the conclusion that the wave-forms due to cloud-to-cloud discharges have features similar to those due to cloud-to-ground discharges in respect of multiple strokes, each stroke showing (i) 'pre-discharges', (ii) return stroke pulses with or without ionospheric reflections, (iii) slow field changes with 'hook'-components of Malan and Schonland and (iv) junction-field changes between two successive strokes.

To decide whether a particular oscillogram of the waveform should be associated with a cloud-to-cloud discharge or not, the two main considerations were as follows :

- (i) In a discharge within a bi-polar cloud with a negative charge below and a positive charge above, the net electrical field change at a distance greater than the critical distance would be negative, whereas a cloud-to-ground discharge would always give a positive field change.
- (ii) In the case of multiple strokes, the time-interval between successive strokes for discharges within the cloud is relatively much smaller than that for cloud-to-ground discharges. The time-interval between the successive strokes in cloud-to-ground discharges as observed by various workers lies within 30 and 200 millise. The moving camera observations of McCann (1944) revealed that the cloud-to-cloud discharges were characterized by much shorter time-intervals between the successive strokes.

2. N. B. BHATT, M. K. GUPTA and Y. S. N. MURTY (Delhi) : *Measurement of Radio Noise in the Delhi Area.*

Measurements of radio noise levels were carried out at several field locations (which also included industrial areas), in and around the city of Delhi (28° 35' N, 77° 5'E) by an objective method using a portable equipment (Noise and Field Intensity meter—model NF-105 manufactured by the Empire Devices Products Corp., New York). The noise level values for the frequency band 150 Kc/s to 21 Mc/s were obtained during the month of July (1958), when the atmospherics levels usually have maximum values during this period of the year. The tables of noise levels are given in field strength values in microvolts/metre per Kc. bandwidth as well as in Noise Power in db above KTB. The results obtained indicate that the noise grade figures for this area need revision.

3. R. N. CHATTERJEE and Y. S. N. MURTY (Delhi) : *Measurement of Radio Noise in Delhi on 150 Kc/s.*

Measurements of Radio Noise Level on 150 Kc/s. were carried out by a direct method at Delhi. The nature of diurnal variation of the mean peak noise level on this frequency was studied. The results were compared with those obtained for the same frequency in the American Sub-Arctic Region, during 1947. A similarity in the nature of diurnal variation for these two places was observed. For both the places the peak noise level was found to be minimum in the early hours of the morning till sunrise, gradually increasing afterwards. It is maximum around mid-day, falling near sunset and increasing afterwards. From this observation, it was suggested that the ionosphere contributes most to the Radio Noise Level around 150 Kc/s. The observed value of peak noise level at Delhi was found to vary between $10\mu\text{V}/\text{Metre/Kc}$ bandwidth and $0.35\mu\text{V}/\text{Metre/Kc}$ bandwidth.

I. SYNTHETIC WORK ON HETEROCYCLICS

Section of Chemistry

Chairman : DR. T. N. GHOSH (Calcutta).

Chairman's Introductory Remarks :

The widespread occurrence of heterocyclic compounds in nature as alkaloids, vitamins, pigments, etc.; their vital role in biological processes; their availability from agricultural wastes and as products obtained in the coking of coal; their economic value as solvents, dyes and pharmaceuticals are factors which have directed the attention of organic chemists to this field since the earliest days of science. As a result, information has accumulated until to-day heterocyclic chemistry constitutes a major branch of organic chemistry. The importance of heterocyclic chemistry is evidenced not only by the volume of accumulated factual information but also by the industrial and biochemical developments and by the possibilities offered for further development.

The subject of discussion is somewhat wide. Nevertheless, in view of the considerable work that has been done and is being done by Indian workers in this branch with significant results, some lines for discussion may be suggested, e.g., (a) pattern of synthesis and reactions of important heterocyclic rings; (b) influence of groups, cyclising agents and other factors on the mode as well as ease of ring-formation; (c) end-objectives of syntheses and (d) naming and numbering of complex heterocyclic systems.

When requested by the Chairman, Dr. T. R. Seshadri (Delhi) opened the discussion and kindly conducted the deliberations.

1. G. S. PURANIK and S. RAJAGOPAL (Dharwar) : *Synthesis of Furano-Xanthenes—analogue of Khellin.*

Benzo- α - and γ - pyrones with a furan ring annealed to them have marked physiological properties as exemplified by the valuable medicinal properties of Psoralen (furo-coumarin) and Khellin and Visnagin (furo-chromone). Based on this knowledge and on analogy thereof, the synthesis of a number of furano-xanthenes which may prove to have valuable therapeutic activity has been undertaken. Since a phloroglucinol nucleus is one which is widely met with in various natural products the synthesis of furano-xanthenes starting with xanthenes with such orientation of hydroxyl groups has been attempted in the first place.

Two alternative routes have been adopted :

(a) 1:3-Dihydroxy xanthone has been formylated by the method of Gattermann. The constitution of the resulting aldehyde has been established (as the 4-aldehydo-xanthone) by its conversion into and comparison with the trihydroxy-xanthone of known authenticity. Advantage has been taken of the facile formation and removal of acetal for purposes of masking the aldehyde group during the next stage of synthesis viz. the preparation of 1-OH-3-carbethoxy-4-aldehydo-xanthone with ethyl-bromacetate.

(b) 1:3-Dihydroxy xanthone has been first converted to the 3-O-carbethoxy ester which on Duff reaction yields an aldehydo acid. The constitution of this acid is under study.

The aldehydo ester or acid obtained by methods (a) or (b) will be subjected to cyclisation to yield the angular or linear furano-xanthone.

2. N. M. SHAH (Ahmedabad) (*in absentia*) : *Some recent work on ortho-hydroxy Acyl Coumarones.*

A search of literature shows that the majority of furano-coumarins or chromones have been synthesised from suitable *ortho*-hydroxy acyl coumarins or chromones, because of their easy availability by the Fries migration of the acyloxy-coumarin or chromone derivatives. The alternative method will be to start with *ortho*-hydroxy-acylcoumarones or their hydrogenated derivatives coumarans, as starting materials and to build up the pyrone ring by suitable reactions.

Ortho-hydroxy-acylcoumarones have been hardly investigated. The author with his students has recently studied the Fries reaction of acyloxy-coumarones with interesting results.

Further, acyloxy-coumarilic acids have also been studied. The possibility of synthesising furano-chromones using the above *ortho*-hydroxy acylcoumarones as starting materials has been also explored.

3. J. N. CHATTERJEA (Patna) (*in absentia*) : *Chromenes and Isochromenes.*

Pyrolysis of *cis-o*-hydroxycinnamyl alcohols give exclusively chromenes; the expected 2-methylenecoumarans and 2-methylcoumarones are not formed.

Iso coumarin has been reduced to (2-hydroxymethyl-phenyl) acetaldehyde which on treatment with sodium acetate-acetic anhydride afforded the hitherto unknown and unstable isochromene. The constitution of the compound rests on its reduction to isochroman.

Indenoisocoumarin has been directly reduced to indeno-isochromene and converted into isobenzopyrylium salt by oxidation with triphenylmethyl perchlorate.

4. V. R. SHAH, J. L. BOSE and R. C. SHAH (Poona) (*in absentia*) : *New Syntheses of 4-hydroxycoumarins and 2:4-dihydroxyquinolines.*

Two new syntheses of 4-hydroxycoumarins are described. In one synthesis, a phenol and a malonic acid are reacted in the presence of a mixture of anhydrous zinc chloride and phosphorus oxychloride, almost a new condensing agent in Organic Chemistry, to give high yields of 4-hydroxycoumarin (Indian Patent 62890 and corresponding U.K., U.S.A., Swiss and German Patents filed). This simple one-stage process carried out under mild conditions is of general applicability and is of industrial importance for the production of 4-hydroxycoumarin, the key-intermediate for the manufacture of the leading anticoagulant drugs like tromexan, dicoumarol and sodium warfarin and the widely used rodenticides, warfarin and tomorin. The

second synthesis of 4-hydroxycoumarins involves the reaction of a diaryl malonate with malonic acid in the presence of a mixture of anhydrous zinc chloride and phosphorus oxychloride (Indian Patent 63083). The mechanisms of the two syntheses are also discussed.

The above syntheses depend upon the specific condensing action of the mixture of anhydrous zinc chloride and phosphorus oxychloride which individually are almost ineffective in these reactions. The use of this mixed condensing agent has previously led to a new and convenient synthesis of hydroxyxanthenes (Shah, Shah and Grover, *J. Chem. Soc.*, 1955, 3982).

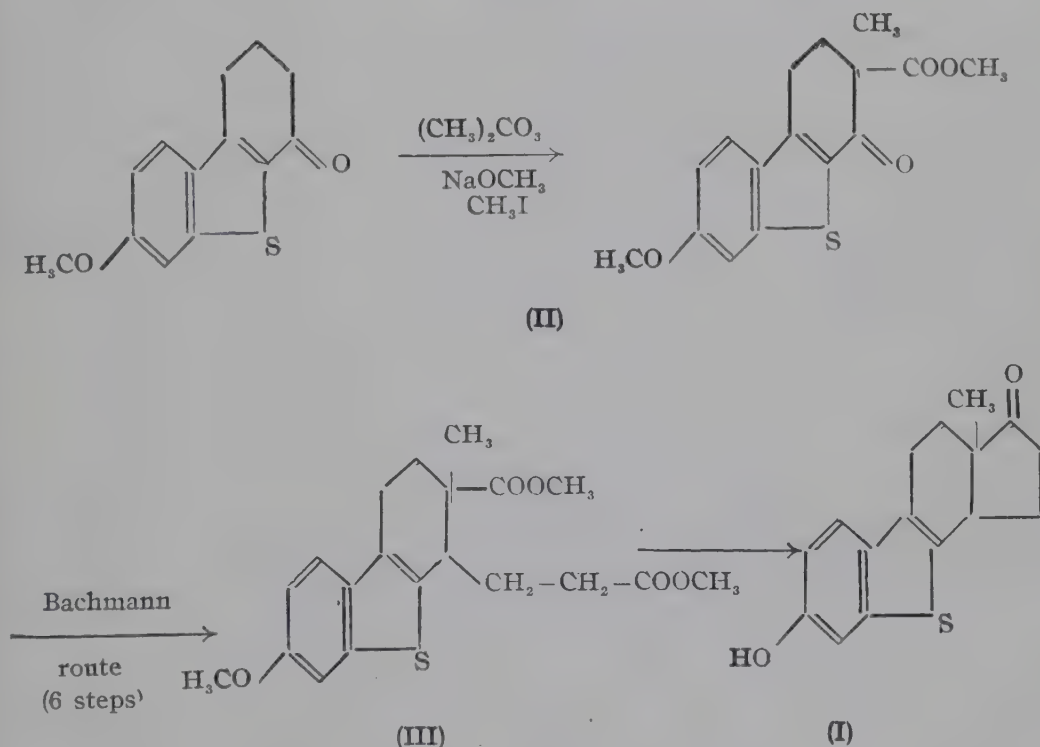
This new condensing agent has also been successfully used for the preparation of 2:4-dihydroxyquinolines from aromatic primary amines and malonic acids (Indian Patent 65777). This general method would make a large number of 2:4-dihydroxyquinolines, otherwise difficult of preparation, readily accessible.

5. M. K. BHATTACHARJEE, G. R. N. SASTRY and B. D. TILAK (Bombay) : *Thiophene Isosters of Equilenin and its derivatives : Synthesis of condensed Thiophenes through Michael Reaction.*

The present communication forms a part of an extensive programme of total synthesis of heterocyclic steroids in progress in this laboratory (Tilak, *J. Indian Chem. Soc.*, 1959, 36, 1). Attempts to synthesise the thioster (I) of equilenin by the Johnson route and by a modified Bachmann route are described.

Synthesis of B-nor-6-thiaequilenin through 3-cyano-7-methoxy-3-methyl-4-oxo-1:2:3:4-tetrahydrodibenzothiophene following the Johnson route was unsuccessful.

Synthesis of (I) by a modified Bachmann procedure starting from (II) has been undertaken. In this connection, compound (III) has already been prepared and its conversion to (I) is in progress.



The stereochemistry of 3-deoxy-B-nor-6-thiaequilenin, m.p. 87-88°, obtained earlier by Mitra and Tilak (Mitra and Tilak, *J. Sci. Ind. Res.*, 1955, 14B, 132; 1956, 15B, 497) was investigated following Bannerjee *et al.*'s stereospecific synthesis of

equilenin (Banerjee *et al.*, *J. Amer. Chem. Soc.*, 1956, 78, 3760). It was shown that in the above compound, C/D rings are cis-fused and the compound is, therefore, 3-desoxy-B-nor-6-thia-isoequilenin.

In order to confirm the above results, synthesis of the other stereoisomer, m.p. 148° described by Mitra and Tilak has been undertaken.

Synthesis of Condensed Thiophenes :

Interaction of 3-hydroxymethylene-4-keto-1:2:3:4-tetrahydro-dibenzothiophene (IV) with methyl vinyl ketone followed by catalytic reduction of the double bond, Wolff-Kishner reduction of the keto-group and subsequent dehydrogenation, gave the known 1:2-benzo-9-thiafluorene (thianaphthene-1:2-b-naphthalene). A repetition of the above steps on the above Michael adduct from (IV) gave the hitherto unreported thianaphthene-1:2-b-anthracene.

6. M. K. ROUT (Cuttack) (*in absentia*) : *Synthesis of some Thiazole Derivatives.*

The synthesis of a number of thiazole derivatives, which have been found to be very effective as (1) photographic sensitisers, (2) antispasmodics and anti-histaminics, (3) amoebicides, (4) anti-malarials and (5) fungicides is described here.

(1) *As photographic sensitisers :*

A number of compounds have been found to possess pronounced photo-sensitising activity. Two are described here : (i) Merocyanine derived from iso-oxazolone + 4-*p*-bromophenyl thiazole methiodide ($n=3$), prepared by reaction in absolute alcohol and triethylamine of 4-*p*-bromophenyl-2-methyl thiazole methiodide and 4-(6-acetanilido 2, 4-pentadienyldiene) 3-phenyl 5-iso-oxazolone; range of sensitisation 580-760 m μ . (ii) Aza-cyanine derived from benzothiazole + 4-phenyl thiazole ($n=3$), prepared by condensation of 2-(6-acetanilido-1, 3, 5 hexatrienyl) benzothiazole methiodide and 4-phenyl 2-amino thiazole methiodide; range of sensitisation 600-780 m μ .

The merocyanines derived from thiazoles can also be usefully employed for determination of relative acidity and relative basicity.

(2) *As anti-spasmodics and anti-histaminics :*

A number of compounds show great promise as anti-spasmodics and anti-histaminics. Two of them are described here : (i) 2-Mercapto 3-*p*-bromophenyl-4, 5 (2', 3')-4'-hydroxyquinolyl-iminazolidone, prepared by fusion of 3-*p*-bromophenyl-2-thiohydantoin and anthranilic acid in presence of powdered anhydrous sodium acetate; anti-spasmodic and anti-histaminic activity 15 μ g/50 c.c. (ii) Mannich condensation product of 4-phenyl-2-amino-thiazole, *p*-hydroxy acetophenone and formaldehyde; anti-spasmodic activity 30 μ g/50 c.c. and antihistaminic activity 23 μ g/50 c.c.

(3) *As fungicides :*

Of the many compounds which have proved very effective as fungicides, two are described here : (i) Acetoxy-mercuri derivative of 2-*p*-chlorophenylimino-4-thiazolidone obtained by mercuration with mercuric acetate of the thiazolidone compound; fungicidal activity—3 parts per million. (ii) Acetoxy-mercuri derivative of 4-phenyl-2-phenylamino-thiazole; fungicidal activity—5 parts per million. The position of the acetoxymercuri group has been fully established. The fungus used was *Alternaria Polanduii* Ayengar.

(4) *As amoebicides :*

Some of the compounds which have been found to possess significant amoebicidal activity are described here : (i) N-(4-phenyl)-thiazolyl-*p*-arsenoso benzamide, prepared by reaction of dichloro-*p*-arsino benzoyl chloride with 2-amino-4-phenyl-thiazole; amoebicidal concentration 1 : 512,000. (ii) N-(*p*-tolyl)-thiazolyl-*p*-arsono-

benzamide prepared from dichloro-*p*-arsino-benzoyl chloride and 2-amino-4-*p*-tolyl-thiazole and subsequent treatment with hydrogen peroxide in glacial acetic acid; amoebicidal concentration—1 : 256,000. (iii) (2-*m*-chlorophenylimino-thiazolidonyl)-*p*-arsenosphenyl ketone prepared by Friedel-Craft reaction of dichloro-*p*-arsino-benzoyl chloride and 2-*m*-chlorophenylimino-thiazolidone; amoebicidal concentration 1 : 256,000. (iv) N-Arsonophenyl 2-(*m*-carboxy-phenylimino-thiazolidonyl) glycine prepared by condensing *p*-arsanilic acid with 2-*p*-chloroacetyl-*m*-carboxy-phenylimino-4-thiazolidone, amoebicidal concentration 1 : 64,000.

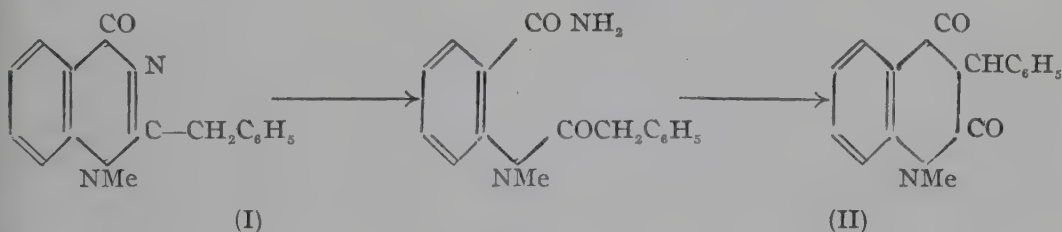
5-Arsonophenyl-2-arylimino-4-thiazolidone, prepared by reacting 2-arylimino-4-thiazolidone with diazotised solution of *p*-arsanilic acid employing conditions under which the diazo compound decomposed by splitting off of nitrogen, was not, however, very active. These compounds were tested against *Entamoeba histolytica*.

(5) As anti-malarial :

One thiazolidonyl biguanide which holds out promise as an anti-malarial has been prepared by reacting 5-amino-*p*-nitrophenylimino-4-thiazolidone with aryl cyanoguanidine. The 5-amino compound was obtained by fission of the corresponding azo compound. Evidences for the placement of the amino group in 5-position have been adduced.

7. R. N. ADHYA, (MRS.) D. CHAKRAVARTI and R. N. CHAKRAVARTI (Calcutta) (*in absentia*) : 3-Substituted Carbostyrils.

In connection with the work on the structure of arborine as carried out in our laboratory it was observed that during alkaline hydrolysis it yielded arboricine, $C_{16}H_{13}O_2N$, in about five per cent yield in addition to the main products, phenylacetic acid, N-methyl anthranilamide, N-methyl anthranilic acid and ammonia. The structure of arboricine as 1-methyl-3-phenylcarbostyril was established by an unambiguous synthesis from ethyl phenylmalonate and methylaniline. The formation of arboricine (II) from arborine (I) may be explained as shown below.



The yield of arboricine by the synthetic method, which involved heating the reactants to a temperature of 210-220° for an hour and a half, was only about fourteen per cent. Recently in connection with our attempt for preparation of a series of carbostyril derivatives it was found necessary to have an easier procedure for preparation of such derivatives in sufficient quantities. In this respect the best method appears to be that of refluxing a mixture of the above reactants in *p*-cymene for about six hours. The yield of arboricine in this case was found to be about seventy-five per cent and the product obtained is pure.

8. A. CHATTERJEE, N. ADITYACHAUDHURI and S. K. SRIMANY (Calcutta) : β -Phenylethanolamines. Part II. Studies on the cyclodehydration of a few acylamido alcohols.

A new method for the preparation of various β -phenylethanolamines was developed (Adityachaudhuri and Chatterjee, *J. Indian Chem. Soc.*, 1959, 36, 585). This

method was extended in the syntheses of aegeline, di-*trans*, N-[β -hydroxy- β -(*p*-methoxyphenyl) ethyl] cinnamamide, the latter occurring in the leaves of *Aegle marmelos* Correa and also in the synthesis of the isoquinoline alkaloid, papaverine.

Since isoquinoline alkaloids are generally synthesised from acylamino derivatives of β -phenylethyl or ethanolamines, it was thought interesting to investigate whether (a) aegeline, N-[β -hydroxy- β -(*p*-methoxyphenyl) ethyl] cinnamamide, (b) dihydroaegeline, *i.e.*, N-[β -hydroxy- β -(*p*-methoxyphenyl) ethyl] dihydrocinnamamide, and such similar amides *viz.*, (c) N-[β -hydroxy- β -(3:4-methylenedioxyphenyl) ethyl] cinnamamide and (d) its dihydroderivative, N-[β -hydroxy- β -(3:4-methylenedioxyphenyl) ethyl] dihydrocinnamamide, the latter two amides being synthesised by the method above, cyclise by Bischler-Napieralski reaction to the corresponding isoquinolines.

The behaviour of the above amides towards cyclo-dehydration appeared to be interesting and is described in this communication. Cyclisation of the amides, (c) and (d), with phosphorus oxychloride in dry toluene afforded the corresponding 1-(styryl)-6:7-methylenedioxy-isoquinoline (isolated as its picrate), m.p. 230-31° (dec.) and 1-(β -phenylethyl)-6:7-methylenedioxy-isoquinoline, m.p. 83-85° respectively in good yield. The synthesis of these two isoquinoline derivatives has not been reported so far.

But aegeline (a) and dihydroaegeline (b) failed to undergo cyclisation when heated with various dehydrating agents under different experimental conditions. Forced cyclisation of aegeline has culminated in the fission of the molecule with the formation of a new product *viz.*, *trans*-cinnamamide, m.p. 140-41° and a dark resinous mass (probably a styrene polymer). Formation of such amides during Bischler-Napieralski reaction is a new observation and has not been reported in the literature so far.

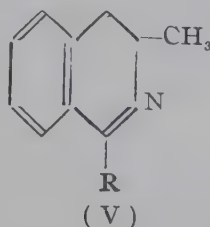
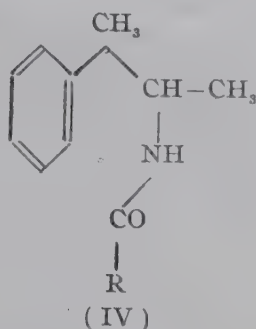
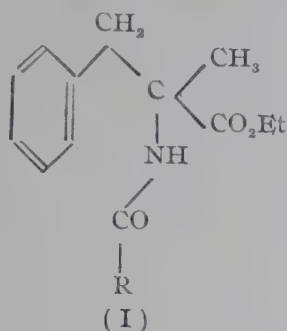
9. BINAY KUMAR GHOSH (Calcutta) : On the formation of Isoquinoline Ring by Bischler—Napieralski reaction.

The Bischler-Napieralski reaction, which has received wide application for the synthesis of diverse types of isoquinoline compounds, consists in the cyclodehydration of β -phenethylamides to 3:4-dihydroisoquinolines by heating to high temperatures in presence of a cyclising agent such as phosphorus pentoxide, anhydrous zinc chloride, phosphorus oxychloride, polyphosphoric acid, etc. So far as this reaction is concerned, very little systematic work has been done on the influence of the cyclising agent or of the substituents at the α -carbon atom to the amino group, or of the acyl group on the ease and course of cyclisation. We have observed that in the case of certain derivatives of β -phenethylamides, these factors appear to play significant roles.

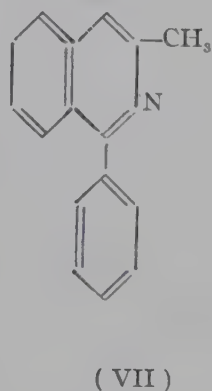
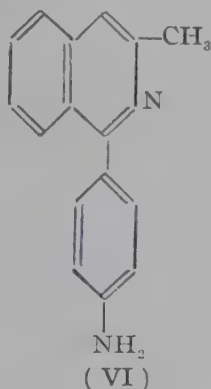
For example, ethyl α -acylamido- α -methyl- β -phenyl-propionates (I), when treated with either phosphorus pentoxide in xylene or polyphosphoric acid at 130–140° or with phosphorus oxychloride in nitrobenzene at 180°, invariably yield the fully aromatised isoquinoline derivatives (II), accompanied by elimination of carbon monoxide. If, however, the nature of the cyclising agent is changed to phosphorus oxychloride in boiling benzene or xylene, the same amide (I) yields the expected 3:4-dihydroisoquinoline (III), provided the group R is an alkyl or phenyl substituted alkyl *e.g.* benzyl. It is of interest to record that by employing the same cyclising agent, the corresponding azlactone is exclusively obtained if R is an aryl group like phenyl or *p*-nitrophenyl.

If in the amides (I) the carbethoxy group is absent, the resulting amides, namely, α -methyl- β -phenethylamides (IV), yield the 3:4-dihydroisoquinolines (V),

whether phosphorus pentoxide or phosphorus oxychloride in an inert solvent is used as the cyclising agent.



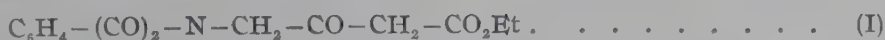
In connection with the dehydrogenation of the *isoquinoline* (V) by palladium-charcoal in tetralin, an interesting case of hydrogenolysis has been observed in that when R in (V) is *p*-nitrophenyl or *o*-(or *p*-) chlorophenyl, the compounds (VI) and (VII) are respectively obtained.



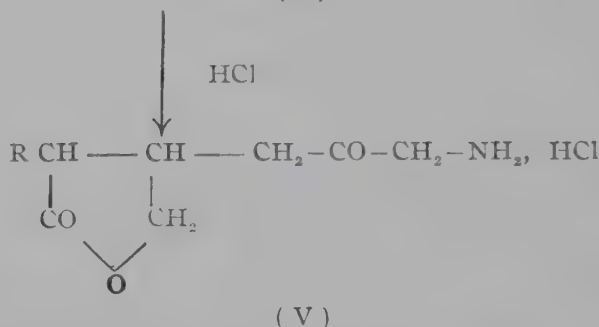
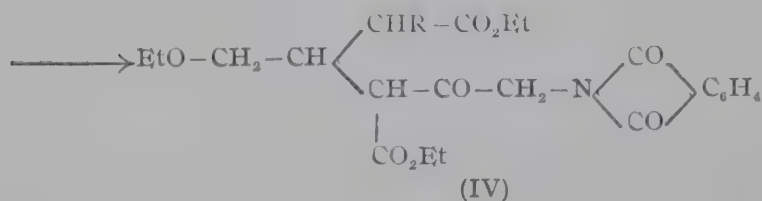
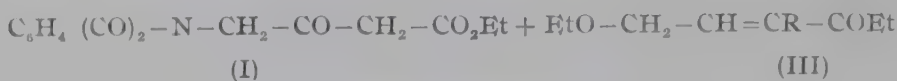
10. A. N. DEY (Delhi) : *A new route for the synthesis of Iminazole Compounds.*

One of the most commonly employed methods for the synthesis of iminazole compounds is to react an appropriate α -amino keto compound with thiocyanic acid or its derivative to furnish the corresponding .2-thioliminazole, from which the iminazole is obtained. However, the preparation of such amino-ketones is not always easy and therefore the method has got limitations.

An alternative method developed by us has been found to offer certain advantages and it has been possible to utilise the same for wider applications. In this method we have utilised γ -phthalimidoacetoacetic ester (I), which was first prepared by Pfehler. This ester, on condensation with alkyl iodides, furnishes the substituted acetoacetic ester (II, R=alkyl). On hydrolysis the latter gives the corresponding amino-ketone, from which the substituted iminazoles have been prepared.



The ester (I) or its derivative can undergo Michael condensation with ethyl γ -ethoxy crotonate (III, R=H) or with ethyl γ -ethoxy- α -alkyl-crotonate (III, R=alkyl). The condensation product (IV), thus formed, is hydrolysed with acid to give the corresponding amino-ketone (V), which in turn, gives the iminazole. In this way the synthesis of the whole series of jaborandi alkaloids consisting of pilosinine, pilosinidine, pilocarpine, isopilocarpine, pilocarpidine and their analogues has been achieved.



Dr. T. R. Seshadri summed up the salient features of the papers presented and then delivered an illuminating lecture on the pattern of synthesis of some physiologically active heterocyclic compounds occurring in nature.

II. ROLE OF IMPURITIES IN METALS AND INORGANIC COMPOUNDS

Chairman: DR. T. N. GHOSH (Calcutta).

Chairman's Introductory Remarks:

The term "trace" was used in the past to denote a quantity which either could not be determined accurately or was not worth determining at all. With the development of highly sensitive and specific analytical methods, this meaning has now been out-of-date. To-day the term has a rather different meaning and in its general sense, signifies a quantity which usually can be determined and is worth determining as well. Just how small this quantity is, is however somewhat arbitrary. W. F. Hillebrand suggested in case of rock analysis that the upper limit should be 0.01–0.02 p.c. The lower figure marks the limit of common volumetric and gravimetric method of analysis and thus may be regarded as the approximate upper limit of a trace constituent.

The development of analytical methods for constituents of this order has resulted in a proper appreciation of the role of trace impurities. Perhaps the most common example is the influence of traces of As, P, C, Si on the mechanical properties of metals and alloys. In the pharmaceutical field, certain elements such as As and Pb are highly undesirable and prescribed limits are of the order of 10–15 ppm. Fluorine is another trace impurity in inorganic chemicals, parti-

cularly those derived, even remotely, from rocks, and is as widespread as sodium, though present in much smaller quantities. There is still no pharmacopoeial limit for fluorine in inorganic drugs, but one may come in near future. It is now generally accepted that a small amount of fluoride in drinking water increases the resistance of tooth enamel to decay. As such, many municipal bodies abroad have adopted the fluoridation of their water supply. Excessive amounts of the order of 1.5 ppm. are again undesirable because they may cause mottled teeth, and still higher concentration may bring about more serious toxic symptoms.

When requested by the Chairman, Dr. N. R. Dhar (Allahabad) opened the discussion and kindly conducted the deliberations. He delivered an illuminating lecture on the subject of discussion and then requested the participants to present their papers.

1. B. CHATTERJEE (Howrah) (*in absentia*) : *The effect of Impurities and Imperfections on the Properties of Metals.*

Impurities and imperfections have profound influence on metallurgical reactions and on the properties of metals and alloys. Embrittlement of metals, intercrystalline cracks, intergranular etching or corrosion, etc. are caused by the presence of either precipitates or equilibrium segregates at the grain boundaries. Solid impurities affect nucleation of new crystals. The presence of dissolved impurities is manifested in the non-uniformity of composition of crystals grown from such solutions. During growth of crystals from solutions containing dissolved impurities new phases may also appear as a result of the increase in the concentration of impurities. The rate of self-diffusion within metallic bodies is markedly changed by the presence of impurities in the solvent lattice. Impurities also help in bringing about phase changes by catalysing nucleation and growth of new phases. The presence of structural imperfections and impurities has been found to change profoundly mechanical properties of metals such as, yielding, work-hardening, creep, etc. and electrical properties such as, resistivity, thermo-electric power, etc. Considerable improvement in the properties of metals has been brought about through systematic investigations of the effects of impurities and imperfections on the behaviour of metals. Activity of metallic catalysts to bring about chemical reactions is largely dependent on the nature of surface imperfections and impurities present. Lastly, the properties of semiconductors are controlled to a very great extent by the small amount of chemical impurities and lattice imperfections present in the system.

2. S. S. VERMA (Calcutta) : *Effect of certain Impurities in Sheet Iron on its enamelling behaviour.*

Ferrous materials contain within their structure small quantities of various solids like C, Mn, Si, P, S, Ti, Al_2O_3 , FeO, and gases like H, N, O, CO, etc. A discussion is presented on the effect of such impurities on the enamelling behaviour of sheet iron and steel.

A brief account of some of the impurities discussed is given below :

Carbon : This is considered the most important element in this context, so much so that sometimes it forms the sole criterion for the selection of sheet iron for enamelling. The iron-carbon equilibrium conditions of all combinations, ranging from pure iron to cast iron containing 4.6% carbon and 95.4% iron, have been extensively investigated by various workers. Enamelling steels usually contain less than 0.20% C. As the C-content increases, a tendency towards blistering sets in.

- Silicon** : This is important in that if it is kept low, steels containing upto 0.50% Si can be enamelled but more than 0.20% Si tends to produce blisters.
- Manganese** : Manganese can counteract the effect of Si but in excess induces crazing in enamels. .
- Phosphorus and Sulphur** : These are present in small quantities in commercial steels but do not appear to affect the blistering tendency of enamels to any appreciable extent.
- Cr, Ni, V, Mo** : These elements do not cause blistering when present in small quantities but nitrides definitely impart this tendency.
- Non-metallic Solid inclusions e.g. Al_2O_3 , FeO , MnS** : These inclusions when present in small quantities in iron and steel, do not cause blistering.
- Gases** : These include H, O, N, CO etc. which get absorbed in iron at various stages of manufacturing like melting or processing like acid pickling, due to its absorptive capacity for gases. A number of the common enamelling defects like blistering and fish scaling have now been traced to these gases, particularly hydrogen.

3. S. R. YOGANARASIMHAN and C. N. R. RAO (Bangalore) : *Impurity effects on the Anatase-Rutile Transformation.*

The transformation of spectroscopically pure anatase to rutile has been investigated in detail earlier. The infinite-time temperature of the transformation has been found to be $610 \pm 10^\circ C$. The kinetics are found to follow the first order rate equation. No induction time was noticed. The energy of activation has been found to be of the order of 90 kcal. per mole. Impurities have been found to markedly affect the transformation characteristics. We have now investigated the kinetics and energetics of the transformation of anatase prepared by the hydrolysis of titanium sulphate. The kinetic data are significantly different from those obtained in the transformation of spectroscopically pure anatase, which is probably due to the presence of sulphate impurity in the sample. Similar results are also found in the transformation of anatase artificially doped with sulphate ions. We have been conducting detailed investigations on the effect of controlled quantities of doped impurities (anions and cations) on the anatase-rutile transformation. Apparently, impurities affect not merely the rates, energy of activation and the infinite-time temperature, but also the mechanism of the transformation.

4. A. P. B. SINHA and A. B. BISWAS (Poona) : *Effect of Impurities on the properties of transition metal compounds.*

The effect of non-stoichiometry or foreign atoms on the properties of transition metal compounds is elucidated with the help of some observations made in this laboratory and elsewhere.

The metal-excess compounds have either interstitial cations or vacant anion sites and are n-type semiconductors. The metal-deficit compounds have either vacant cation sites or interstitial anions and are p-type semiconductors. It is discussed how impurity cations with valency lower than that of host cations can produce interstitial metal ions, vacant anion sites or a p-type semiconductor, and how cations with valency higher than that of host metal ions can produce vacant cation sites, interstitial anions or n-type semiconductors. The energetics governing the stability of one type over the other is discussed.

The ionic defects—vacancies and interstitials—affect diffusion, ionic conductivity and the kinetics of solid-state reactions whereas the electronic defects change the semiconducting, optical, magnetic and catalytic properties of these solids.

5. S. K. BHATTACHARYA and N. D. GANGULY (Kharagpur) : *The Role of Impurities on Inorganic Solid Catalysts.*

The remarkable influence of impurities, present even in minute quantities, on the physical and chemical properties of metals and inorganic compounds has been known and subsequently been utilised in industry for a long time.

The adverse effect due to the presence of arsenic, antimony, and bismuth as impurities on the electrical conductivity of copper, improvement of the elastic and plastic properties of iron by incorporating small quantities of chromium, vanadium, molybdenum etc., wilful addition of impurities to semi-conductors to bring about desirable changes in their properties, are only a few examples illustrating the role of impurities in shaping the properties of metals and inorganic compounds.

But the role of impurities, whether present unwarranted or by wilful incorporation, becomes all the more remarkable, significant and fascinating in the field of heterogeneous catalysis. The presence of a foreign substance, either in the body of the catalyst or in the reactants may tell upon adversely or favourably on the entire course of a catalytic reaction.

The authors in the present paper dwell on the influence of impurities on a number of heterogeneous catalytic reactions of industrial importance as well as of theoretical interest studied by them during the last fifteen years. The authors have also discussed how the processes like ammonia synthesis, Fischer-Tropsch and related synthesis, Bergius' process of liquifaction of coal, etc., respond to the presence of impurities in the reaction zone (i.e. either in the catalyst or in the reactants).

Lastly, the intricate and ramified influence of the impurities, either in promoting or poisoning the catalytic activity, has been discussed from a theoretical point of view.

6. M. L. SEN GUPTA (Calcutta) : *The Role of Impurities in Inorganic Pharmaceutical Compounds.*

In any chemical process industry one may observe the influence of one or other foreign substance in altering the characteristics, behaviour and speciality of a commercial product. Depending on the use to which the material is put, an associated impurity may sometimes act as an inert diluent or as an objectionable contaminant. There are many instances where the properties of a chemical in bulk are influenced by small quantities of a foreign substance, e.g.

Magnesium Chloride in common salt.

Calcium Chloride in Magnesium Chloride.

Alkali in aluminium hydroxide gel and synthetic aluminosilicates.

Iron in Caustic soda, Calcium Carbonate, Magnesium Chloride, etc.

The presence of an undesirable substance may affect the physical as well as functional property, may hinder in the processing, and/or, may affect the keeping properties of the products. Thus small quantities of adsorbed impurities alter the drying characteristics of many filter cakes. In reactions involving oxidation, reduction, traces of foreign substances, particularly metallic ions, may affect the process significantly. In certain cases, traces of a foreign substance are purposely added to bring about a desired change. The change in the viscosity of inorganic metal hydroxide suspensions or the stabilisation of solutions of hydrogen peroxide or sodium metabisulphite are instances on this point.

For inorganic pharmacopoeial products, limits of certain impurities have been prescribed and methods for their estimation laid down. To control production so that the specified limits are not exceeded is frequently a difficult job and requires

judicious selection of raw materials, equipments and processes. To assess the probable limit of contamination from all different sources calls for accurate methods of estimation.

Several points as cited above have been discussed in the paper.

7. V. YATIRAJAM and J. GUPTA (Poona): *Separation of Zirconium from Hafnium by Frontal Elution on a Silica Gel Column.*

Almost absolute freedom from neutron absorbing hafnium is necessary for the use of zirconium in the construction of nuclear reactors. Due to their almost identical properties, however, zirconium and hafnium always occur together in minerals and are difficult to separate for the same reason.

Of the latest methods of their separation, ion exchange, solvent extraction and silica gel adsorption chromatography, the last is unique in its simplicity and also deals with relatively large amounts of zirconium in a single cycle. The original method of Hansen and co-workers utilises the moisture-sensitive tetrachlorides of the elements for their separation. These are rather difficult to prepare and are reactive to many organic solvents which may be used for their solution. It is shown that the more easily obtainable oxychloride hydrates of these elements can be used with advantage for chromatographic separation on activated silica gel. Operational data on the method are discussed.

8. B. C. HALDAR (Bombay): *Estimation of trace impurities in metals and inorganic compounds by thermal neutron activation method.*

The production of high purity materials and the study of the effects of impurities in solids demand analytical methods of high sensitivity and specificity. Activation analysis meets both the requirements and is ideally suited for the quantitative estimation of trace impurities in metals and inorganic compounds. The thermal neutron activation method is based on the formation of radioactive isotopes in an interaction of an element with the thermal neutrons. The activity produced by irradiating a sample with the thermal neutrons can be expressed by the equation.

$$A = \frac{I\sigma}{M} \times g \times x \times 6.02 \times 10^{23} \left(1 - e^{-\frac{0.693t}{T_{1/2}}}\right), \text{ where } A = \text{no. of disintegration per Sec.,}$$

I = no. of thermal neutrons per cm^2 per Sec., g = amount of the element being determined, M = atomic weight of the element, x = % abundance of the isotope producing the activity, σ = absorption cross of thermal neutrons, $T_{1/2}$ = half-life of the radioisotope produced, t = time of irradiation. In practice a standard sample containing a known concentration of the element to be analysed is activated and processed in the same manner as the known sample. By comparing the radioactivity of the desired radioisotope in each sample it is possible to determine the concentration of the element of interest in the known sample. This method has been used to estimate microgram quantities of halides in Zinc sulfide phosphors and submicrogram amounts of Copper and arsenic in silicon and germanium used in semiconductors. It has also been used to determine trace impurities in super pure materials required in nuclear technology. It is almost impossible to mention all the examples of application reported in the literature. So the present review reports a limited number of typical examples in some of the most important fields of investigation. The main advantages of this method over other physical methods are (i) freedom from the danger of trace contaminants and reagent blank difficulties and (2) its applicability to materials of complex composition.

Dr. T. S. Vishwanathan, Dr. H. V. K. Udupa, Dr. K. S. G. Doss, Dr. J. Shankar and Dr. K. P. Sinha also took part in the discussion.

I. PRE-CAMBRIAN STRATIGRAPHY OF INDIA

Section of Geology & Geography

Chairman : W. B. METRE.

1. A. K. DEY, (Cuttack) : *Pre-Cambrian Stratigraphy of India.*

In Indian stratigraphic terminology four main groups have been recognised, namely :—Archaean; and the "Purana," "Dravidian" and "Aryan" of the late Sir Thomas Holland.

As in other countries, the Archaeans comprise of crystalline schists and gneisses, metamorphosed sedimentary and igneous rocks, forming the basement on which the other groups were deposited. The "Purana" included the unfossiliferous pre-Cambrian rocks, mainly less metamorphosed than the Archaean, and except in the Aravalli region least affected by the batholithic intrusions. The "Eparchaean Break" between these groups has been assumed to have been everywhere of immense duration, but much of the undoubtedly great interval between the Dharwarian (Archaean) and Cuddapah (Purana) of Southern India must have been occupied by the formation, infilling and compression of the Eastern Ghats. A whole group (or era) may be assumed to have been necessary for these processes, and we may call it "Orissan", since the most typical areas are now included in the State of Orissa.

The Aravallian sub-group should be referred to the lower Purana rather than the Archaean, and the Cuddapah or Rialo-Delhi to the Upper Purana. The Vindhyan may belong to a group between Purana and Dravidian, as radioactive age determination of post-Delhi intrusions indicate that an interval of that magnitude exists.

Thus the pre-Cambrian rocks should be classified under at least *four* instead of *two* groups as in America.

PURANA	}	Vindhyan (?)
of Holland		Purana (restricted)
"ARCHAEAN"	}	Orissan
		Dharwarian

The rocks of the Dharwar group have been metamorphosed in varying degrees by subsequent earth-movements and widespread granite intrusions. Subsequent to their upheaval, the Dharwars were subjected to prolonged denudations, so that what now remains of them in places is only a series of inclusions in the later granites and gneisses. No final agreement has yet been reached as to the number of phases of synorogenic granitisation involved. However, the charnockites and khondalites appear to be metamorphosed rocks of the Eastern Ghats geosyncline, with additional material introduced in its compression and granitisation, and the Closepet granite (or equivalents with various local names) is the post-orogenic intrusions associated with the same phase. There may be a whole group (or era) between the Peninsular and the Charnockite-Closepet phases, to the sediments of which the khondalites belonged; as this group required a name, and the State of Orissa includes the best known localities, the name "Orissan" is tentatively suggested.

The pink Closepet granites are probably represented by pink and red granites occurring throughout the Peninsula, including the Bundelkhand granite in the north and the pink type of Myllem granite in the Shillong plateau. The grey Myllem granite is known to be associated with charnockitic rocks, and the Bundelkhand granite passes to a grey type in the Aravalli region, so that perhaps the grey facies is somewhere associated with the geosyncline bordering the Peninsular block.

The Aravallian sub-group is known to be unconformable on the Bundelkhand granite, boulders of pink granite also occur in the Chilpighat formation, which is

believed to belong to the Sausar-Sakoli & Gangpur-“Iron-ore Series” trough of probably similar age. The Bijawars of central India are probably also Aravallian, as may be the Dalings, Chandpurs, Jutoghs, Salkhalas or Vaikritas in the Himalayan belt. The Cuddapahs of the south, Rialos and Delhis of the north-west, and possibly the Buxa rocks of north Bengal, seem to form the upper sub-division of the same group separated from the Aravallian by the Eripura granite and possibly represented in Singhbhum by the Kolhan Series which followed the Singhbhum and Chota Nagpur granitic phases. The post-Delhi granites, followed by the Idar granite, Malani Rhyolites, etc., separate the metamorphic groups of the Aravallis from the Vindhyan rocks, (which transgressed onto all the other formations after prolonged erosion interval in most areas).

The “Eparchaean Interval” in Southern India includes the duration of the Aravallian sedimentation, while in the north-west it is split into the pre-Aravallian and post-Aravallian breaks of shorter duration. The determination by A. Holmes of the age of post Delhi pegmatites in Rajasthan indicates that there is room for a whole group (or era) between them and the late pre-Cambrian. The Vindhyan rocks may belong to this interval, which corresponds broadly to the Algonkian of North America, though they may yet prove to be Paleozoic.

The latest pre-Cambrian System is probably associated with the Cambrian in the Haimanta sub-group of the Himalayas (—Dogra slates of Kashmir).

2. MIHIR KUMAR BOSE, (Calcutta) : *On the growth of the Indian Peninsula and its bearing on Precambrian Correlation.*

The strike trends of the Archaean, the sequence of orogenic processes established by radioactive age determinations and recognition of the shield nucleus, all are suggestive of marginal accretion and gradual expansion of the Indian peninsula. These orogenic belts distributed in space and time can not offer exact lithologic and stratigraphic equivalents.

The Archaean history of Mysore is unique and the area satisfies the characteristics of a shield nucleus. Here in Mysore (i) the volcanics and parametamorphics lie in long narrow belts forming plunging synclinal troughs and with granites spatially distributed between the belts (ii) the oldest volcanics are mafic to intermediate in character and subaqueous (iii) a high ratio of volcanics to sedimentary (iv) abundance of chalcophile ore deposits. The Aravallis may be the continuation of the Dharwar arcs or an independent, synchronous one and wants detailed stratigraphic study. The Eastern Ghats run in arcs with concavity towards the growing continent and have a faulted boundary against the latter. The localised occurrences of the Granulites, Khondalites, Charnockites, Anorthosites, suggest a deep burial, probably caused by a tidal drag against the stabilised cratonic sector. Similar association can not be expected in other belts. Opposite the two prominent nodes of the Eastern Ghats, lie crescentic basins of Cuddapah and Bastar, Bilashpur, with the features of secondary arcs and hence they are older than the schistose rocks (Archaean) of the Satpura belt. The Vindyan basin wants more attention. The southern boundary of the younger Satpura province is defined by a thrust against the stabilised land mass.

In Indian Peninsula, the spatial disposition of the mobile belts with interval of time suggest shifting of position of the primary arcs with independent cycle of evolution. The sialic plate with all its complexities is constituted of parametamorphites and transformed gneisses and granites, representing the roots of the mobile belts and hence can not have stratigraphic correlation in different belts.

II. ROLE OF GEOLOGY & GEOGRAPHY IN THE ENGINEERING PROJECTS

Chairman : W. B. METRE.

1. P. C. HAZRA, V. S. KRISHNASWAMY, V. PRASAD, B. M. HUKKU : *Contribution of Geology to the construction of the Bhakra Dam Project.*

About 200 miles north-west of Delhi, a 740-foot-high concrete dam is being constructed on Lower Siwalik sandstones, having subordinate claystone bands. The contribution of the authors relates to the construction work since 1953.

The Upstream and the Downstream Cofferdams had cut-off trenches and a line of grout holes. Geological mapping revealed a number of low-angled, downstream-dipping faults which necessitated cognisance in grouting and modifications in the design of the Upstream Cofferdam. After construction, only one percent of the anticipated leakage took place through the foundations of this dam.

The construction of the main dam involved a huge amount of excavation, until at least three-fourths of the foundations were on sound rock. The weaker zones persisting after this general excavation were mapped and trenched on the basis of the 'Shasta Formula'. Geological studies during excavation led to the discovery of 22 cross-shear zones in the abutments. As these weak zones would permit seepage, settlement and sliding, special treatment was accorded to them. A major diagonal shear zone in the right abutment had to be replaced with concrete to a maximum lateral depth of 100 feet. In the Middle Third Claystone, the discovery of duplication in width by strike faulting dictated a modification in design and the evolution of special excavation methods. The most difficult and unprecedented excavation was done by mining methods in the Heel Claystone, down to a depth of 140 feet below the bedrock level.

Geological mapping of the mining hatches, formula trenches, six different types of tunnels and the final foundations of the dam, guided many aspects of construction. Geological advice also covered a wide variety of construction problems, including the stability of slopes of deep excavations, foundations of transmission towers, switchyard, power plant and hoist chamber, consolidation and curtain grouting and selection of pozzolanic materials.

2. P. C. HAZRA, P. B. SRINIVASAN & B. M. HUKKU : *Contribution of Geology to the Construction of the Banihal (Jawahar) Tunnel, Jammu and Kashmir State.*

The Jammu-Srinagar Highway, which crossed the Pir Panjal range at an altitude of 8989 feet, used to get snow-bound during the winter, thereby, causing dislocation of land communications between Jammu and Kashmir provinces. The Low-level Banihal tunnel was, therefore, proposed at an altitude of 7200 feet, in order to ensure an all-weather highway. The construction of the Project, comprising of twin tunnels, each approximately 1.6 miles long, was started in 1955 and is under completion now.

The tunnels were driven through highly folded and faulted rocks, ranging in age from the Upper Carboniferous to the Permian and, comprising of agglomerates, the Panjal traps and the slates and limestones of the Zewan Series. These formations are crossed by the tunnels, nearly at right angles to their strike and have moderate to steep dips. The Panjal traps occupy the central section of the tunnels, while the Zewans and the agglomerates occur, respectively, towards their north and south portal ends. The faulted contact of the Zewans and the traps exhibited very little shearing at the tunnel grade.

During construction, the design of the tunnel lining was guided by the structural conditions of the rock as classified on the lines suggested by Terzaghi, but

with modifications to suit local conditions. Advice was also given on the formulation and locations for installation of drainage and water-proofing measures against considerable seepage of ground-water and, on the choice of suitable concrete aggregates.

As the Project is located in a highly seismic belt, a factor of 10 percent gravity was included in the design of the structures. Articulated joints were also provided in the tunnel lining across fault zones and the contacts of stronger and weaker rock zones, so as to prevent a complete failure of the lining in the event of any seismic movement along such zones.

3. S. P. JALOTE : *Investigations Concerning the Seismicity of the Satlitta Thrust in relation to the Beas Dam Project.*

The Satlitta Thrust occurs about two to three miles downstream of the Beas dam-site, which is located about 28 air-miles south-east of Pathankot. The objective of the geological studies was to find out whether or not any movement had taken place along this thrust during the Recent times.

The Satlitta Thrust has brought the Upper Siwalik Pinjor sand-rock and clay-shales over the gently dipping sub-Recent deposits of gravel and clay. Lahiri was of the view that this post-Upper Siwalik thrust, with a throw of 5000 feet, had undergone Recent rejuvenation. The current studies have indicated that on account of the rejuvenation of the thrust after the deposition of sub-Recent terrace deposits, a minimum cumulative vertical displacement of 200'-300' may have taken place. A clearly marked rejuvenation seems to have occurred during the Recent times, and this is indicated by the thrusting of the Pinjors over the Recent *nala*-bed gravels exposed in some of the exploratory trenches.

During the Kangra-Earthquake of 1905, it appears that there was no movement along the thrust. Further, the longitudinal sections of the *nalas* flowing across the trace of the thrust do not show any conspicuous "nick points" near the locations of the thrust, although, it is conceivable that such "nick points", even if they had been developed by rejuvenation of the thrust, may have been obliterated by rapid erosion in the area. The balance of evidence is in favour of continued movement on the thrust and it is concluded that the thrust is likely to be revived during any future earthquakes of severe intensity in the area; therefore, the conservative choice of a seismic factor of 0.3g has been recommended for the design of this 350 to 400-foot-high multipurpose earth-dam.

4. K. N. SRIVASTAVA : *Geological factors responsible for the leakage from the Dhandraul reservoir, Mirzapur District Uttar Pradesh.*

The 1960-foot-long, 67-foot-high Dhandraul Dam is located on the Ghaghar Nadi, near Churk. The foundation rocks are the massive and compact (Vindhyan) Dhandraul Quartzites, which dip at an angle of 20° in a northerly or upstream direction. Although such foundations would generally be considered ideal for siting dams, the joint-planes in the rocks are closely spaced and open, often upto 3" to 4" in width, and are fairly continuous even upto a length of 20 ft.

The Dhandraul Dam was completed during the year 1917 and leakage of water from its foundations, started after a trouble-free performance of 9 years. The initial discharge of 5 to 6 cusecs in 1926 gradually increased to 30 cusecs by 1936. Efforts to control the leakage (probably by local blanketing) were made in 1936 and a temporary success was achieved; but four years later, the leakage again reached a peak. The natural, compacted, oil infillings in the voids between the joints and

the artificial blanket of soil provided in 1936 were probably able temporarily to hold back the water and these may have been gradually removed by the phenomenon of piping under a sustained hydraulic head.

Grouting was tried in recent years, but with no salutary effect, probably because of the localised nature of this operation. It is expected that the leakage can be greatly controlled, by following a properly planned programme of staged, curtain grouting with quick-setting cement, coupled with concrete back-filling of open joints and cavities from the surface down to accessible depths. The leakage problem at the Dhandraul dam emphasises the need for paying attention to a relatively insignificant weakness in the foundation of an otherwise ideal site for a low dam.

5. V. S. KRISHNASWAMY, S. N. CHATURVEDI, S. P. JALOTE : *Significance of the Regional and Local Geological Structures in the Planning of the Beas Dam Project, Punjab.*

The Project is located on the Upper Siwalik to Recent formations and includes the construction of a 400-foot-high earthen dam across the Beas river. The dam-site is situated on one limb of a major syncline, whose other limb will be submerged by the reservoir. Therefore, the foundation deformations and the increased seepage, which are likely to be originated by the loading and the recharge in the reservoir area, require cognisance.

The reservoir will spread mainly over partly saturated sand-gravel formations under a suspected influent ground-water regimen. However, the high artesian ground-water levels existing in the rim rocks and the occurrence of impervious beds dipping towards the reservoir are expected to prevent sustained leakage.

The Beas syncline is cut out three miles downstream of the dam-site by a major, rejuvenated thrust of sub-Recent age; this has dictated the inclusion of a 30 per cent seismic factor in the designs. The thrust is acting as a natural outlet to the artesian basin and, after construction, may guide piping on account of increased piezometric head in the pervious foundation members.

The sand-rock and the interbedded clay-shales at the dam-site are not exposed over a large area and form part of a minor anticline which crosses obliquely the axis of the dam on the left abutment. Faulting is suspected in the covered portions in the left abutment and in the river section. The available evidences are indirect and are also susceptible to an alternative interpretation against the existence of faults. Therefore, an under-water exploratory tunnel, closely spaced additional drilling and geo-hydrological tests have been recommended.

The designs are strongly influenced by the physical and engineering properties of the foundation rocks and by the local geological structures. The excavations, if done without the aid of pressure-relief-wells, will be limited by the existing artesian conditions.

6. V. S. KRISHNASWAMY : *A discussion of the Geological Factors determining the feasibility of the Konch Dam Project, U.P.*

The Konch dam-site is located on the Middle and Upper Siwalik rocks about six miles upstream of the Tajewala Headworks. Although the site was found unsuitable for a low masonry dam in 1942, a 300-foot-high earthen dam was proposed in 1957 in view of its promising potentialities for irrigation, power generation and flood control, particularly for Delhi.

The regional structure consists of a syncline and two anticlines, the dam being located across one limb of the syncline. A major tear fault of post-Lower Pleistocene age, lies partly in the left abutment and the river section. The possibility of movements along this tectonic feature is confirmed by the tilted terrace deposits and

their apparently dissimilar lithology at the same levels on either abutment, all of which points to recent seismicity of the area and the need for inclusion of 30 percent seismic factor in the designs.

The steeply dipping pervious sand-rock beds in the river section are blankets by 150 to 300-foot-thick gravels and sands. As no impervious sub-strata exist upto great depths, control of leakage and the preservation of the carbonate cement in the sand-rock involves elaborate and special foundation treatment. The right abutment consists largely of boulder-gravel and conglomerate and, the pervious beds in the syncline here may facilitate distant leakage through the same. The left abutment consists of 50 to 150-foot-thick terrace deposits, underlain by highly weathered and pervious sand-rock beds. A number of auxiliary dams, deep cut-off trenches and special grouting techniques are indicated for controlling leakage through the abutments. Further costly diversion tunnels and a chute-type of spillway have to be constructed largely through or one poorly consolidated and pervious rocks.

In view of the difficult foundation problems involved and the forbidding cost of the dam and the appurtenant works (119 crores), the Project was deferred.

7. P. N. MEHTA : *Significance of the Regional and the Local Geological Structures in the Planning in the Yamuna Hydel Scheme, U.P.*

The Yamuna Hydro-electric Scheme in Uttar Pradesh envisages the short-circuiting of the double loop of the Tons river by a 7-mile-long tunnel and using the approximately 600-foot-fall available for hydro-power. Different lay-outs of the scheme have been studied, in order to permit the optimum utilisation of the water resources and to conform with the known geological and engineering site conditions.

The main geological problem relates to the driving of a portion of the tunnel through two major thrusts, which may be seismic, viz. the Krol thrust and the Nahan thrust and, the intra-thrust zone of crushed Dagshai(?) shales. In order to counter the problem of seismicity, this portion of the pressure tunnel has been recommended to be replaced by a tail-race tunnel.

The present studies have indicated that the Krol thrust may have been modelled on an erosional surface and, therefore, it may not have an uniform, northerly dip, as was visualised earlier. Further, recent field work in the vicinity of the Project area has indicated that there are no adequate grounds to interpose a thrust contact between the Dagshais and the underlying Nahans. It has tentatively been proposed that even if the Nahan thrust is positively proved to be present in the area, the Krol and the Nahan thrusts lie so close to each other that from an engineering point of view, only one continuous weak zone may be encountered by the tail-race tunnel.

The detailed local geological studies of the Kalsi Dam Site—a component of the 1958 lay-out have revealed that a number of faults are present in the Nahan rocks forming the foundations of the proposed masonry dam and that their treatment would influence the construction cost. An alternative site or an earthen dam on less complex foundations has been chosen on the basis of mapping.

8. K. C. C. RAJU : *The influence of Geological features in the selection of the Suketi Dam site, Beas Sutlej Link Project, Himachal Pradesh.*

The Suketi Dam was proposed as a 430-foot-high earthen structure, to be constructed south of Mandi, Himachal Pradesh. For this dam, four alternative sites, located respectively, at mile No. 1, 1.5, 2 and 3 along the Mandi-Sundernagar Road, were considered.

In the Mandi area, the formations ranging from the pre-Cambrian to the Tertiary have been brought into juxtaposition by major thrust faults, viz. the Kasauli-Trap thrust, the trap-Chail thrust and the Chail-Krol thrust. These thrusts lie very close to or within the area of the proposed dam and have dictated the choice of the site.

From the studies conducted for the siting of the dam, it is tentatively concluded that all these thrusts have been seismically inactive, at least since the sub-Recent times. However, as the project sites fell within isoseismals 9 and 10 (Rossi-Forrel) of the Kangra Earthquake of 1905, which emanated 46 miles N. W. of Mandi, a high seismic factor has to be incorporated in the design of the dam.

The site at Mile No. 1 will be founded mainly on the traps, except for bands of brecciated limestone, calcareous shale and grit and sandstone-siltstone, all of which may have been brought within the traps by folding and faulting. The site is not structurally ideal and the quality of the foundation rocks has to be improved by extensive grouting. The Kasauli-Trap and the Trap-Chail thrusts lie outside the limit of the dam in the abutments.

The foundations of the second alternative site are similar to those of the first site. At the third alternative site, the Trap-Chail thrust lies within the dam area in the river section. At the fourth alternative site, the Krol-Chail thrust lies transverse to the dam axis in the left abutment.

9. V. S. KRISHNASWAMY : *Geological notes on the Beas-Sutlej Project, a major scheme or the inter-linking of the rivers in the Himachal Pradesh and the Punjab.*

The Project envisages the diversion of the Beas waters through a system of lakes and tunnels, into the Sutlej at Dehar, near the head of the Bhakra reservoir. In the process of diversion, the net height differential of about 1000 feet would be utilised for power generation.

The Project area is of great academical importance, as it exposes a wide variety of formations and formational contacts, like the Chails, the Krols, the Kasauli-Dagshais, the Siwaliks and possible Tertiary granites and traps. All the Project sites are subject to earthquake hazards and an analysis of past earthquake records has given some guidance on the choice of an aseismic design factor for the various structures.

The 700-foot-high Larji dam near Kulu will be located in a tectonic window of the Shali dolomites and limestones, which have been subjected to chemical solution, besides numerous small scale folds and faults. The low diversion dam at Pandoh, 12 miles downstream from Larji, will be founded on the Chail phyllites, largely covered by thick gravel deposits. The 300 to 400-foot high Suketi dam, which will store the diverted supplies from Pandoh, will be founded on Jaunsar (?) or Tertiary (?) traps, with included limestones. The 5-mile-long Pandoh-Suketi tunnel will cross the Chail-granite (Tertiary?) contact and, over 50% of its length will be in good granites. The 9-mile-long Suketi-Dehar tunnel was originally contemplated amidst the Kasauli-Dagshai formations; but, geological studies have guided the selection of a better tunnel route in the Krol or the Shali rocks. The Dehar Power House will be founded on sound dolomites. The 300-foot-high Pand (Beas Dam) will be located on soft, Pinjor sandrock and clay-shales and, besides the impoundment of the reservoir on sub-Recent and Recent gravel deposits, construction has to deal with many original foundation and design problems.

I. PHYLOGENY AND EVOLUTION IN PTERIDOPHYTES

Section of Botany

Chairman : PROF. P. N. MEHRA.

1. A. ABRAHAM (Trivandrum) : *Cytology and Phylogeny of the Pteridophytes.*

From a careful cytological study of a large number of Pteridophytes occurring in South India and comparing the data with what has been published on the cytology of the same and related groups elsewhere, important conclusions have been drawn. Some of these are briefly mentioned below:—

1. Discussing the phylogenetic aspects and inter-relationships of the primitive ferns in the light of chromosome numbers, the families Marattiaceae, Gleicheniaceae and Matoniaceae, all having the basic chromosome number 13, are shown to be interrelated. Evidence of chromosome numbers in ancient genera like *Psilotum*, *Marattia*, *Matonia*, *Hymenophyllum*, *Dicranopteris* etc. show that 13 is probably a common basic chromosome number in ancient vascular plants.

2. The genus *Lycopodium* with unrelated basic numbers like 11, 12, 13 and 17 is shown to be a multibasic genus, and in this respect this genus is strikingly different from most of the other genera of Pteridophytes, especially those of the primitive groups.

3. Except in the possession of heterospry, *Selaginella* and *Isoetes* are considered unrelated and this has been justified in their possession of unrelated basic chromosome numbers like 9 and 11 respectively.

4. *Botrychium*, *Helminthostachys* and *Ophioglossum* are shown to have chromosome numbers in multiples of 15 and on this ground these three genera, although unlike in morphological details are suggested to be taken as closely related.

5. Among the leptosporangiate ferns it is seen that in most of the families the basic chromosome numbers fall between 29 & 41. The probable evolutionary relations of the various families of ferns are discussed in the light of evidences from cytology.

6. Polyploidy is seen to have played significant role in the evolution of species in the Pteridophytes. A good number of ferns are found to be high polyploid strains, and in the attainment of high levels of polyploidy the Pteridophytes as a whole have gone far beyond any other group of plants. Aneuploid changes resulting in speciation have also been noticed.

7. The relation between chromosome size and chromosome number in the pteridophytes is discussed. It is shown that the generally accepted idea that within closely related species higher chromosome numbers are associated with relatively smaller size of chromosome is of no general validity as far as the Pteridophytes are concerned.

2. G. PANIGRAHI and S. N. PATNAIK (Shillong) : *Phylogenetic studies in Polypodiaceae (sensu stricto).*

A comparison of the scope and limits of *Polypodium* and Polypodiaceae (Linn. 1753) with those of *Polypodium* and Polypodiaceae *sensu stricto* (Copeland 1947, Pichi-Sermolli 1958) would suggest any student of phylogeny the incomprehensible taxonomic upheavals through which the genus and the family have passed over a period of two hundred years. While Copeland (l.c.) divides the 65 genera of his family Polypodiaceae into 8 distinct groups, Holttum (1947, 1954) suggests the separation of *Grammitis* group of genera to a separate family Grammitidaceae, co-ordinate in rank with that of Polypodiaceae. Pichi-Sermolli (l.c.) on the other

hand raises Polypodiaceae—*sensu* Copeland (l.c.) to the rank of order Polypodiales, within which, he recognises four families Dipteridaceae, Cheiroleuriaceae, Polypodiaceae, and Grammitidaceae.

While summarising the views of Seward (1922), Bower (1933), Copeland (1947) Holttum (1947, 1954) and Pichi-Sermolli (1958) on the evolutionary trends in the Polypodiaceae *sensu* Copeland (l.c.), this paper presents in tabular forms the up-to-date cytological data on the 37 species mostly from Malaya and Ceylon worked out by Manton in England and on 15 East Indian species of the family worked out recently by the authors, and attempts to re-evaluate the classical views on the affinity between the genera and the evolutionary trends within the family.

The monotypic genus *Pseudodrynaria*, Ching based on *Drynaria coronans* (Wall.) J. Sm. showing $n=36$ in Khasia hills stands apart from the other species of *Drynaria* having $n=37$. The discovery of three deploid species and one tetraploid species of *Loxogramme* with $x=35$ in Khasia and Jaintea Hills would justify the inclusion of *Loxogramme* along with *Lepisorus* ($x=35, 36, 37$) in the Polypodiaceae rather than in Grammitidaceae characterised by $x=36, 37$ and $x=37-38$.

The possession of $x=36$ in *Microsorium*, *Phymatodes*, *Colysis*, *Leptochilus*, *Pseudodrynaria* and *Photinopteris* confirms their close affinity within the group Microsorieae. But Copeland's hypothesis for merging *Arthromeris* with its parent genus *Crypsinus* having $n=33, 36$ is disproved by the discovery of $n=37$ in *Arthromeris wallichiana* (Sprg.) Ching from Shillong.

Cytological studies involving 52 species of Polypodiaceae showing four distinct base numbers, viz 33, 35, 36, and 37 and reveal only 17 per-cent of polyploidy with 7 species occurring as tetraploids and only 2 species attaining hexaploidy. It appears, therefore, that aneuploidy and genic mutations, rather than emiploidy provide the principal impetus for evolution within the family, occurring largely as epiphytes in the tropical and subtropical evergreen forests.

3. D. S. LOYAL (Chandigarh) : *Some evolutionary trends in family Thelypteridaceae with particular reference to Himalayan species.*

The Himalayan representatives of the family Thelypteridaceae (*sensu* Ching) have been studied from cytomorphological, taxonomic and phylogenetic standpoints. On the basis of present data, it may be stated with reasonable certainty that these ferns have a common ancestral stock and the family taken as a whole, represents a highly natural assemblage. The preponderance of species based on $n=36$ in *Thelypteris* and the occurrence of the same number with no variants, in *Cyclosorus*, *Abacopteris* and *Ampelopteris*, suggests that the Thelypteroid stock with $n=36$, has given rise to a group of genera centred around *Cyclosorus*. On the morphological basis, it appears that an increase in the extent of lamina in this group of *Thelypteris* species, followed by the fusion of one or more pairs of veinlets below the sinus, resulted in the distinctness of the genus *Cyclosorus* from *Thelypteris*. The augmentation of the tendency towards the entireness of lamina, evidently resulted in Goniopteroid and Meniscioid venation seen in genera centred around *Cyclosorus*. Since a vast majority of these ferns occupy shaded habitat, hence such a development is not improbable under such conditions. In the evolution of this group of genera, mutations (chromosomal and genic) are involved, because the basic set of 36 chromosomes is retained in all the three genera investigated. On the *Thelypteris* side, however, there is some indication of an aneuploid series and several base numbers are evolved accompanied by, in some cases, non-indusiate soral condition and its elongation along the veinlets. Some of these members have previously been included in such genera as *Phacopteris* and *Leptogramma*. The writer is in favour of their inclusion in the genus *Thelypteris*, because the above two genera are based on characters which are inconstant at the generic level.

The present study also reveals the existence of complete reproductive isolation between the various chromosomal lines. This is supported by the fact that species with such close numbers as $n=35$ and 36 when growing in mixed populations have never shown evidence of hybridization. The cytological data, further, indicate besides mutation and aneuploidy, the role of polyploidy and hybridization in speciation. Apogamy, characteristic of several advanced Leptosporangiate ferns, is conspicuously absent.

The evolutionary trends of morphological characters have been studied in *Thelypteris* only and tentative conclusions drawn are given below. The creeping posture of the shoot is a uniform character and minor variations observed are perhaps due to physiological and ecological factors.

The linear-lanceolate frond form is associated with species which grow in forest, whereas the species growing in exposed localities possess deltoid frond form and show higher degree of pinnation than the former. The former perhaps represents the original condition and the latter derived one.

There are evidences in favour of the view that a non-indusiate sorus and its slight elongation along the veinlet is a derived condition, from a zygomorphic, lop-sided sorus with horse-shoe shaped indusium—a condition original in the family.

The dwellers of forests possess sori either near the costa or in the centre of the costule, thus appearing in two distinct rows. The inhabitants of low-land open valleys show a marked decrease in the extent of lamina and the sori are located close to the sinus. Furthermore, the number of sporangia per sorus is markedly less than in the former types.

The spores are of three types, each characterizing broadly a group of closely allied species. (a) More or less rounded, blackish brown with spiny perisporium are seen in species having 36 or 35 chromosomes and also in several species of *Cyclosorus*. (b) Broadly oblong, spores with brownish and verrucose perisporium, are seen in some species of *Thelypteris* with $n=35$ as well as in some species of *Cyclosorus*. (c) The third type is seen exclusively in species with $n=31$. They are nearly bean-shaped, yellowish light brown with very poorly developed perisporium.

Studies on the dermal appendages indicate that unicellular needle-like bristles is an ancestral character which gave rise to lanceolate type of scales. A comparative study of the gametophyte belonging to two chromosomal lines viz. 36 and 31 show more or less identical characters.

The evolutionary tendencies summarized above, are depicted in two diagrammatic sketches for projection.

4. S. C. VERMA (Chandigarh) : *Variation and Evolution in Onychium.*

Genus *Onychium* is small, comprising nearly of 10 species of which 8 occur in the Sino-Himalayan region, especially Yunnan-Himalayas, which represent its centre of distribution. Hence an analysis of its morphological, anatomical and cytological variation and their correlation in the evolution of various species was considered desirable.

MORPHOLOGY :

In spite of the small size of the genus, morphologically it can be divided into four distinct groups, namely, *Siliculosum* (one species), *Melanolepis* (one species), *Japonicum* (six species) and *Contiguum* (one or two species). *Siliculosum* corresponds to Sect. *Euonychium* Ching and the rest three to Sect. *Leptostegia* Ching. The morphological criteria involved are : rhizome posture and interned structure, scales, colour of stipe, nature of sori and indusia, nature of spores, and above all

the length of sori. Each group is distinct, so much so that the polyploid taxa in *Japonicum* and *Contiguum* groups (cf. Table I) do not indicate any combination of characters that differentiate the two groups or even the diploids of these groups. This perhaps implies that evolution has proceeded within each group and not between groups.

Anatomy :

Each morphological group is distinctive in its anatomy and this character too may be as useful in a taxonomic study as the other characters. *Siliculosum* : *Onychium siliculosum* has a medullated solenostele and a unitary leaf trace with an immediate closure of the foliar gap by a compensation strand from the central medullary stele. Rhizomes are ascending to sub-erect. The immediate closure of foliar gaps retains the solenostelic nature of the outer cylinder, thus affording to bear large number of roots and closely set leaves.

Japonicum : *Onychium japonicum* and *O. lucidum* possess dorsiventral rhizomes with laterally borne leaves. These are facultative solenostelic with a binary leaf trace and a little admixture of xylem parenchyma. The presence of roots on the dorsal face too is due to submerged nature of rhizomes. *O. ipii* is rather transitional between radial and dorsiventral types. Leaf trace initiates unitary but matures into a binary one. *Contiguum* : Creeping and radial rhizomes exhibit characteristic dictyostely usually with 3-5 (6) meristeles in a section. Dictyostely is the result of elongated foliar gaps and radial symmetry. Equally characteristic is the presence of sclerotic patches in the ground tissue, sufficient xylem parenchyma and pinna trace extramarginal (also in *Japonicum*). May it be emphasized that Ching (1934) has referred the rhizomes to be creeping, solenostelic, and leaf trace binary for the entire genus which on the basis of present data seems incorrect. *Melanolepis* : it is not represented in Himalayas but in its marginal pinna trace, it is not related to *Japonicum* and *Contiguum*.

CYTOLOGY : The genus is equally absorbing in this respect too. All the three investigated groups are based on 29. *Onychium siliculosum* is diploid. *Japonicum* group includes three taxa, a diploid (*O. japonicum*) a tetraploid (*O. lucidum*) and a hexaploid (*O. ipii?*). *Onychium japonicum* var *lucidum* is raised to a specific status on cytogenetical basis. The two taxa of *Contiguum* group, *O. contiguum* and *O. plumosum* (Yunnan taxa) are taken tentatively to be synonymous. As such three races, diploid sexual, diploid apogamous and a triploid apogamous, occur in the Himalayas.

INTER-RELATIONSHIPS :

Since the groups are morphologically distinct and even in the polyploid types this distinctness is maintained, their evolution is to be sought for within the groups themselves and not between groups.

In the *Contiguum* group, the three races belong to *O. contiguum* and diploid sexual is very close to the type. From a critical analysis of the two diploids, it is held that here apogamy has arisen as a local variant in the diploid sexual. The suggestion is further supplemented by writer's observations in *Pteris quadriaurita* complex. It is suggested that it is not essential everywhere for hybridity to precede apogamy. The triploid apogamous forms have evolved through diploid apogamous and diploid sexual taxa, and are thus 'autotriploids'. Restricted distribution of both the apogamous taxa indicate their recent origin.

In the *Japonicum* group a tetraploid and a hexaploid is so far discovered. The tetraploid *O. japonicum* var *lucidum* is taken to be distinct species (*O. lucidum*) cytogenetically coupled with morphological distinctness. The morphological comparison render it to be a good intermediate between *O. japonicum* and *O. tenui-*

frons, which is suggestive of their being parental to the tetraploid. All the three taxa occur in Yunnan. *O. tenuifrons* is theoretically diploid. The tetraploid is thus a genomic allopolyploid.

The hexaploid, *O. ipii* is a fresh report for Himalayas and shows intermediacy in morphological characters between *O. lucidum* and *O. moupinense* which are suggested to be the two parents involved. The three taxa occur sympatrically in Western China especially Szechwan. *O. moupinense* is again theoretically a diploid and needs confirmation. *O. ipii* is thus a genomic allohexaploid.

PHYLETIC CONSIDERATIONS:

Creeping and radial types are believed to be primitive. Solenostelic forms have given rise to dictyostelic condition by way of elongated foliar gaps and retention of radial symmetry (*O. contiguum*).

5. S. S. BIR (Chandigarh) : Evolution in the Indian members of genus *Asplenium* Linn.

Evolution in the genus *Asplenium* Linn. has been explained from two aspects, viz. morphological and cytological with a main stress on the data available from studies on the Indian members.

Asplenium exhibits extreme type of diversity as far as the outline of frond, venation and soral characters are concerned. Following three evolutionary groups seem to have evolved from the *Euasplenium* section among the Himalayan members :

(1) *Asplenium Dalhousie-paucivenosum* group

The members are almost identical to the frond form in *Ceterach officinarum*. On the basis of venation pattern, there is a clear indication of how *Ceterach* has been evolved from *Asplenium* through *A. dalhousie*. *Ceterach* shows advancement over these *Asplenium* species in the loss of indusium and in the presence of anastomosing veinlets. The presence of scales on the underside of lamina in *Ceterach* is possibly an adaptation to the xerophytic environments in which the members usually grow.

(2) *Asplenium nidus* group

This group shows a definite advancement over previous one due to the presence of a transverse intramarginal veinlet and is mainly represented by *A. nidus*.

(3) *Asplenidictyum* group

It is represented by *A. finlaysonianum*. Here the venation is areolate near the margin of the frond and thus it is a well advanced group.

On the basis of peculiar venation and geminate sori, never met within true *Asplenium*, *Phyllitis* deserves a generic rank with position next to *Asplenium*.

From cytological considerations Himalayan members are in active state of evolution as is indicated by a high percentage of polyploids and hybrids compared to diploids. Out of 35 taxa investigated, 29 are sexual and six hybrids; amongst the sexual polyploidy is significantly high (79.31%) and this is in strong contrast to the other Himalayan fern genera as *Athyrium*, *Diplazium*, *Dryopteris* etc. The tetraploids are the commonest and the grade of polyploidy is only upto octoploid level. *Asplenium unilaterale* is the most interesting 'species complex' yielding 3 forms namely (i) a diploid sexual with $n=40$; (ii) a 'diploid' hybrid

with $2n=76$ and (iii) a 'triploid' hybrid with $2n=112$. This is the first case of detection of dibasic hybrids in ferns. In addition, an autotriploid with $2n=120$ of its var. *udum* has also been detected. Only one species, namely, *A. cheilosorum* shows an apomictic life cycle being triploid apogamous with $2n=108$. Furthermore, two species, *A. varians* and *A. paucivenosum*, show intraspecific polyploidy, the $2x$ & $4x$ forms of the former are almost similar, while in the case of the latter $4x$ & $8x$ forms show quantitative differences.

The existence of several cytotypes within various species from the Himalayas reveals that polyploidy and hybridity have played a significant role in the evolution of microspecies in the region.

Furthermore, the finding of $x=40$ in *A. unilaterale* gives some support to Hayata's (1927) genus *Hymenasplenium* which incidentally is typified by this species. Since there are no specific morphological and anatomical characters on which *Hymenasplenium* can be separated from other *Asplenium* species, therefore, in the author's opinion a genus cannot be recognized on purely cytological grounds.

6. C. MAHABALE (Poona) : *Evolutionary tendencies in Azolla.*

The paper gives an account of the broad trends in evolution of the genus *Azolla* such as the number of float corpuscles, massulae, glochidia, stele etc. The vegetative structure and stele seem to have undergone reduction of an amphiphloic siphonostele to protostele, but the massulae have been elaborated from eglochidiate condition to one highly evolved on two lines (A) *A. filiculoides* type and (B) *A. pinnata* type. The number of chromosomes has apparently not changed but these are races adapted to temperature and tropical waters in lakes. From what earlier ferns this genus has arisen is debatable. The two main types of members in the genus are *Azolla filiculoides* and *Azolla pinnata* and have world wide distribution throughout the Tertiary period. The original home of the genus seems to be Africa. The genus is essentially a Tertiary fern.

7. S. BHAMBIE and V. PURI (Meerut) : *Shoot Apex Organization in Lycopods.*

Shoot apex organization in Pteridophytes was at one time considered to be a simple affair. The occurrence of a single apical cell with two or more cutting faces was believed to be the rule. Lately with the appearance of more detailed and systematic studies we have begun to realize the complexities of the subject. Even in the living Lycopods there is considerable variation and specialization.

In many of the species of *Selaginella* studied the shoot apex in mature plants is somewhat flattened dorsiventrally and exhibits lateral symmetry. At the extreme tip there is a laterally oriented band of three, four or more wedge-shaped cells, larger in size, poorer in cytoplasm and vacuolated. Other cells of the apex are homogenous and do not appear to be specialized in any way. In vertical longitudinal sections such apices show only a single large cell simulating a single apical cell. Earlier records of a single apical cell in this genus perhaps relate to such sections alone. The most active meristematic region in *Selaginella* is situated on the sides in the region where leaves initiate.

In *Lycopodium* the shoot apex is found to be of two more or less distinct types. In slow growing species (sub-genus: *Urostachya*), it is either flat or more or less dome-shaped measuring about 600μ above the youngest leaf primordium. In fast growing species (sub-genus: *Rhopalostachya*), on the other hand, it is conical and projects considerably above the youngest leaf primordium, being over 2000μ in *L. clavatum*. In all the species studied there is a discrete outer superficial layer of somewhat columnar cells covering an inner mass of cells showing little stratification. The greatest meristematic activity, as in *Selaginella*,

is observable on the sides of the apex in the region where leaves initiate, while some of the central cells of the apical layer appear to be larger in size, poorer in cytoplasmic contents and vacuolated, at least in certain species.

In *Isoetes coromandelina* the shoot apex has been studied in all stages of developments and it shows much variation in form. Histologically it has a single superficial layer of large columnar cells that divide mostly anticlinally. The cells covered by this layer are fewer and show irregular divisions. The most active meristematic region here too is on the sides of the apex where leaves initiate.

One feature that presents itself rather boldly is the apparent inactivity of the extreme terminal cells of the apical meristem in these species. What exactly is the role of these cells is a problem that is engaging our attention at the moment.

Another point that is brought out is that these three genera—*Selaginella*, *Lycopodium* and *Isoetes*—form an ascending series in so far as the complexities of the shoot apex organization are concerned. But we have no intention of suggesting that they constitute a phylogenetic series. Ontogenetic studies in our understanding have little to contribute to phylogenetic speculation. Such an attitude in our opinion will avoid much confusion.

II. CYTOGENETICAL EVOLUTION IN ANGIOSPERMS

Chairman : PROF. P. N. MEHRA.

1. M. L. MAGOON and S. RAMANUJAM (New Delhi) : *Cytogenetical mechanism underlying species differentiation in the tuber-bearing Solanums.*

The section Tuberarium of the Genus *Solanum* consists of more than 100 species, including the economically important potato (*S. tuberosum*), divided, according to the latest concept, into 17 different taxonomic series. Cytogenetical investigations, however, reveal an unexpected situation in that viable hybrids can be obtained between widely separated taxa. Furthermore, these hybrids exhibit a high degree of pairing comparable to that which would be expected in intra-species or nearer crosses. It is, therefore, interesting to inquire into the major cytogenetical factors which are responsible for differentiation in this group.

Once such obvious factor is the occurrence of polyploidy, the highest level reached being the hexaploids ($2n=72$). However, the nature of such polyploidy i.e. whether auto- or allo- or a combination of both is a matter of controversy. Except possibly at the hexaploid level, the discrimination between these alternatives is complicated by the uncertainty regarding the basic chromosome number in the group. While some workers feel that $n=12$ is the basic chromosome number, evidence from other studies has been interpreted as suggesting a lower basic number. Naturally one's interpretation of the type of pairing occurring in species hybrids depends upon one's concept of the basic chromosome complement.

Another factor commonly involved in preventing free gene flow between related species is structural change of the chromosomes. Evidence is now available to show that gross structural changes resulting in cytologically detectable irregularities does occur among the species. Also, the chromosome complements of many of these species differ by small structural changes which do not lead to cytologically visible abnormalities—the so-called "Cryptic" structural differences. Genetical studies have been rather scanty but there is some evidence that gene substitution of modifier complexes could also have played a part in the differen-

tiation of these species. Some preliminary evidence is also available that cytoplasmic differences between these species exist.

It appears then, that the mechanism responsible for speciation in this group are the same as have been shown to lead to internal isolation in other taxa.

2. T. N. KHOSHOO (Chandigarh) : *Cytogenetical Evolution in the Sisymbrium Irio Complex.*

Cytogenetical mechanisms underlying evolution within *Sisymbrium irio* Linn., are presented in this communication.

A combined genecological, morphological, cytogenetical and geographical analysis reveals that the genetic diversity is primarily due to auto- and/or allopolyploidy, and secondarily to the gene mutations and structural alterations in the chromosomes.

At least two (A and B) and at the most three (A, A₁ and B) genomes have been interwoven by polyploidy to give rise to one phylogenetic unit, containing three distinct polyploid races 4x, 6x and 8x) and stray triploid hybrid individuals. Furthermore, at the tetraploid level there have arisen three distinct ecotypes due to genic differentiation. These types seem to have arisen due to selective action of edaphic and biotic factors. The hybrids between the raw and the synthesized polyploids have revealed the role played by structural alterations in chromosomes in their evolution.

An important feature of the evolution within this complex is the simultaneous and abrupt origin of the barriers to crossability of the various races, because polyploidy *per se* acts as an effective barrier. Its action is supplemented by habitat preferences, autogamy and chromosomal sterility. The various races do not show strong morphological differences, but with the strong isolating mechanism in operation, these are likely to evolve independently and may, in course of time, attain the requisite morphological distinctness.

In short the species complex is able to maintain its far-flung boundaries because of its excellent genetic system which promotes weedy tendencies. Furthermore, it shows the combined role of hybridization, polyploidy, gene mutations and structural alterations in chromosomes involved in the variations and evolution within the limits of one Linnean species.

Interesting data have been obtained for several other species and it is hoped that in due course of time it will be possible to present an integrated picture of evolution of the angiospermic element of the Punjab Flora. This in turn is likely to throw light on the composition, evolutionary status, affinities and migration of the flora of this region in relation to the past geographical and geological events.

3. J. VENKATESWARLU (Waltair) : *Cytogenetic Evolution in Maydeae.*

Cytogenetic evolution in the sub-tribe Maydeae is discussed in respect of the available data like chromosome numbers, morphology of pachytene chromosomes, position of centromere in relation to the length of arms, the position of nucleolus organiser, presence and absence of knobs, and the euchromatic or differentiated nature of chromosomes of its members. In this discussion author's observations on the various populations of the two species of oriental genus *Coix* ($n=5$), *C. aquatica* and *C. lachryma-jobi* are also included.

C. aquatica has the longest pachytene chromosomes in Maydeae so far studied with a length range of 112—70 μ . Heterochromatic segments are present.

In the case of *C. lachryma-jobi* populations differ in respect of the nature of chromosomes, some possessing chromosomes all euchromatic while there are others with heterochromatic segments.

This comparison shows that cytologically corn and *Euchlaena* resemble each other very closely and also with some races of *C. lachryma-jobi* while *C. aquatica* and *Tripsacum* belong to the other category resembling each other in possessing differentiated chromosomes with heterochromatic segments.

The great cytological resemblance of corn and *Euchlaena* is further proven by the formation of fully fertile hybrids with normal meiosis. Crossability experiments performed by the author between *Coix aquatica* and *C. lachryma-jobi* as female and maize as male parents have been unsuccessful, the few viable seeds obtained being those of *Coix* indicating probable apomictic development.

In *Coix aquatica* populations have been observed which are triploids or tetraploids or others in which are observed translocations at the pachytene stage. Duplications, deficiencies and inversions are also suspected in this polymorphic species.

4. S. V. S. SHASTRY (New Delhi): *Pachytene analysis in application to Evolutionary Problems in the Genus Oryza.*

Cytological studies made in the genus *Oryza* by way of pachytene analysis in four species—*O. sativa*, *O. glaberrima*, *O. stapfi* and *O. australiensis*, four inter-sub-specific (*japonica-indica*) hybrids of *O. sativa* and one inter-sectional hybrid, *O. sativa* × *O. officinalis* are discussed in relation to (1) Karyotypic diversity in cultivated rices, (2) evidence for chromosomal sterility in *japonica-indica* rice hybrids and (3) isolation mechanisms in the differentiation of the sections *Sativa* and *Officinalis*.

The wild species, *O. stapfi* and *O. australiensis* are characterised by more symmetric karyotypes than the cultivated species, *O. glaberrima* and *O. sativa*. Further, within the species *O. sativa*, the primitive sub-species, *indica* is characterized by more symmetric karyotypes than the sub-species *japonica*.

Pachytene analysis in *japonica-indica* hybrids revealed the presence of differential segments which are inferred to be the sites of translocations. High sterility, low recovery of recombinants, occurrence of abnormal plants and high genetic instability can all be understood by the cytological aberrations recorded. These results offer reinterpretation to Oka's (1957) hypotheses on genic sterility.

The chromosome complements of *O. sativa* and *O. officinalis* have been assigned to different genomes since this hybrid forms 24 univalents at metaphase I. It was recorded that pairing at pachytene was surprisingly normal and hence it was concluded the cause for complete univalent formation is due to desynapsis rather than due to lack of homology. Desynapsis as an isolation mechanism in this genus is discussed.

5. VIRENDRA KUMAR (Delhi): *The role of introgressive hybridization in the evolution of Angiosperms.*

The frequent occurrence of hybridization and its role in evolution in angiosperms has been widely acclaimed. In recent years, however, a greater evolutionary significance has been attached to "introgressive hybridization" or commonly called "introgression" (Anderson and Hubricht, 1938). The phenomenon involves infiltration of a few genes of one species into the gene pool of another, via a partially sterile F_1 hybrid, by a series of successive back-crossing with either parent. This results in bringing about a wide array of variants in the species population.

An important prerequisite for the degree of introgression in a species population has been the presence of a disturbed habitat in the region, where overlapping of the geographic range of the species concerned, has occurred.

Anderson (1943) has recommended use of the following methods for detecting and analyzing introgression in any species population: (1) Scatter diagrams, (2) Pictorial scatter diagrams, (3) Ideographs, (4) Hybrid indices, (5) Radiate indicators, (6) Standardized photographs, (7) the method of extrapolated correlates.

One of the important outcomes of the studies on introgression, has been the use of the methods of extrapolated correlates in phylogenetic studies. Recently, it has been effectively used in ascertaining the origin of B genom in bread wheat (Sarkar and Stebbins, 1956). By using this extrapolation technique, the percentage of a suspected hybrid can be known with much greater accuracy and convenience.

The role played by introgressive hybridization in the evolution of angiosperms is in many ways similar to the evolutionary divergence through mutations, recombinations and selection. However, the difference lies in that not one single gene but a constellation of genes, are incorporated into the germplasm of the other species through transfer across a reproductive barrier. Thus, if the diverging hybrid swarm possesses an adaptively valuable gene combination, it can invade the new unoccupied environmental niche, made available by the disturbed habitats. Recognition of the important role which introgression has played in plant evolution and familiarity with the methods of analysing the nature and extent of introgression by plant collectors and systematists would result in a wealth of new information.

6. G. PANIGRAHI and R. V. KAMMATHY (Shillong): *Studies in the Cytomorphology of Aneilema sensu lato in Eastern India.*

Clarke's system and nomenclature of the genus *Aneilema* (cf. Hooker's F.B.I., 6, 1894) includes all the Indian species under the sub-genus *Euaneilema*. Yet, Bruckner's (1930) revival of the genus *Murdannia* Royle (1839) has necessitated the transfer of 12 of the 16 East Indian species of *Aneilema* (*sensu lato*) to the genus *Murdannia*. Of the four remaining species, while *A. protensum* Wall and *A. thomsoni* Cl. represent undoubtedly *Aneilema* *sensu stricto* in East India, the determination of the generic affinity for *A. conspicuum* Kunth and *A. montanum* Wt. awaits further study of living specimens. This paper presents our observations on the nomenclature, habit, habitat, and distribution of 12 species of *Murdannia* and 2 species of *Aneilema* in Eastern India and attempts to visualise the cytomorphological evolution in the group by correlating our cytological data on five species of *Murdannia* with those of Murthy (1936), Simmons (1954) and Sharma *et al* (1955, 1958).

Murdannia hamiltoniana (Wall) Bruck. with its axillary flowers borne on jointed pedicels and bearing 15-20 seeds per cell of the capsule and growing in road side marshes and swamps should be treated as a distinct species from *M. terminalis* (Bl.) Raizada, characterised by mostly terminal inflorescence, possession of only 2 rugose seeds per cell and growing on hill slopes and moist sandy alluvial plains. It is, therefore, improper to cite *M. hamiltoniana* (Wall) Bruck. as synonymous to *M. terminalis* (Bl.) Raizada, as suggested by Raizada (1958).

Murdannia gigantea with $n=11$ in the grassy hill slopes of Shillong provide, a different base number viz., $x=11$ in *Murdannia*, a genus otherwise characterised by an euploid series based on $x=10$ as determined from the study of the biotypes of *Murdannia nudiflora* with $n=10$, *M. spirata* with $n=20$, *M. divergens* with $n=30$ and *M. simplex* with $n=40$ in the Khasia Hills. *M. simplex* growing *sympatrically* with *M. gigantea* turns out as a new record for Eastern India. Our findings thus confirm Sharma & Sharma's (1958) conclusion on the absence of any correlation between altitude and grade of polyploidy in this group.

M. terminalis (Bl.) Raizada shows striking ecotypic variations and may be considered as a polymorphic species.

7. D. SRINIVASACHAR (New Delhi) : *Induction of "reductional groupings," (Somatic reduction) by centrifugation followed by colchicine treatment.*

The author while working at the University of Wisconsin found that the frequency of metaphase "reductional groupings" (somatic reduction) could be greatly increased if colchicine treatment was combined with centrifugation. In onion roots grown in 0.5% aqueous colchicine for ten hours and subjected to centrifugation at 1500 ppm. for five minutes 23.4% metaphase "reductional groupings" were obtained as against 3.9 in the untreated controls. Centrifugation probably helps grouping of chromosomes which are lying free in the plasma due to the paralysis of the spindle mechanism by colchicine.

"Reductional groupings" occur sporadically in nature. Their frequency can be increased by sodium nucleate (Huskins, 1948). Colchicine also causes "reductional groupings". This was made use of by Franzke and Ross (1952) in practical plant breeding. They obtained constant breeding variants from sibs of a true breeding variety of *Sorghum*.

The role of polyploidy, with or without previous hybridization, is well recognised as a factor in evolution. Where fertility in new combinations is impaired by synaptic irregularities meiotic divisions often serve as a regulating mechanism to produce balanced gametes. Similarly where sterility may be due to chromosome unbalance or genic incompatibility somatic elimination might serve to establish a compatible complement. Reduction of chromosomes in mitosis has been reported in many cases including cotton, *Rhoeo*, onion and *Ribes*. If polyploidy is important in evolution it is also reversible: autotetraploids may throw off triploid and diploid shoots and complex polyploids may revert to ancestral forms. The phenomenon of "reductional groupings" was probably involved in these cases.

III. INDUCED MUTATIONS

Chairman : PROF. P. N. MEHRA.

1. M. S. SWAMINATHAN (New Delhi) : *Induced mutations in relation to species evolution and crop improvement.*

Recent research has indicated that induced mutagenesis can serve as a refined tool in investigations on the structure and function of genetic elements. The extent of elegance possible in such studies will be evident from the demonstration that most reverting point mutations of phage T-4 correspond to the change of a single nucleotic pair in DNA. Induce mutations are also helpful in tracing phylogenetic relationships and they have helped to elucidate the nature of macromutations frequently found in the genus *Triticum*. Such macromutations appear to have played a major role in the differentiation of sub-specific categories in *Triticum*. Finally, induced mutations are growing in importance in the field of plant breeding. Their importance lies in the fact that they provide unusual opportunities for new recombinations particularly among tightly linked loci, for causing specific deletions, for increased crossing over and the attendant enlarged polygenic variability and for the inactivation of cross-incompatibility mechanisms. The various procedures useful in mutation breeding will be outlined and the design of the "Gamma Garden" set up at the Indian Agricultural Research Institute will be described.

2. S. BHASKARAN and V. L. CHOPRA (New Delhi) : *Mutagenic effects of free radicals and stored energy.*

Radiation damage in biological material is now believed to be caused to a great extent by the formation of free radicals of different species and much indirect evidence has been accumulated to this effect. So far the studies were confined to the investigation of the formation and detection of free radicals following irradiation; but a direct approach to their role in the production of chromosome breakage is lacking. Experiments were conducted in this laboratory and evidence will be presented to show that the free radicals produced chemically are capable of diffusing inside the cells and cause chromosome aberrations like chromosomal and chromatid breaks, dicentric bridges and micro-nuclei in plant material. Recent researches have also shown that besides free radicals, stored energy possibly possessing radiomimetic properties is also formed in the irradiated food stuffs. Such studies are important to evaluate the utility of irradiation in food preservation. The role of free radicals and stored energy following irradiation of biological material in causing mutations will be discussed.

I. DEFINING CULTURE ZONES OF INDIA

Section of Anthropology & Archaeology

Chairman : DR. P. C. BISWAS.

At the suggestion of the President, Dr. S. C. Sinha opened the discussion describing, very briefly, the project of survey of some selected material traits all over the 322 districts of India undertaken by the Department of Anthropology, Government of India, since October 1959. Dr. Sinha suggested that plotting of the distribution of such material traits as settlement pattern, house-type, bullock-carts etc., poses interesting questions as to the relation between culture on the one hand, and natural environment, language, ethnic concentration and migration on the other.

Dr. S. D. Kaushik emphasised that culture is the total-complex of man-made traits over natural traits: "The consequence of people's symbiotic ecological adjustment with the physical milieu and also within the human society itself, according to the needs, tastes and talents of the community and individuals. It includes adaptive attitudes, habits, patterns and techniques of collective living. Not only the physiography, climate, soils, minerals, flora, etc., but also the ideas, beliefs, and degree of culture-contact govern the mainsprings of culture.

In defining the Culture Zones of India, the scientist has to assort his data according to the spatial distribution of the ingredients. The culture-isopleths of communities are to be plotted on maps. Then, the complex picture is to be visualised by superpositions in this sequence :—

- (1) Dress and sartorial style; appearance.
- (2) Settlement patterns; house types; building material; architectural style.
- (3) Dietary; mode of cooking and eating; communal drink.
- (4) Language.
- (5) Land utilisation; economic occupation; stage of ecological succession; crafts.
- (6) Density of population; rural-urban ratio.
- (7) Tools and implements pertaining to household, agriculture and crafts.
- (8) Irrigation system : canals; persian wheels; buckets.
- (9) Transport : animals used; carriages; roads; railways—per capita mileage.
- (10) Family life : (a) Joint or separate; (b) division of labour between males and females; (c) kinship; (d) marriage system; (e) rights of eldest brother; (f) rights of daughters.

- (11) Social organisation: (a) Division of labour amongst social classes; (b) traditions, codes of behaviour, moral laws; (c) Co-operation in agriculture and crafts; (d) social institutions; (e) control by village Head man or Panchayat.
- (12) Superstitions; magico-religious rituals.
- (13) Folk-lore; festivals; modes of recreation.
- (14) Education in males and females.
- (15) Culture-contact; historical succession.

These ingredients differ from one culture-zone to another. The writer has tried to analyse the Culture Zones of India. It is found that Culture Zones are not merely physiographic zones, nor administrative states, nor linguistic provinces. There are 12 Culture Zones, with several sub-zones of each, given in the paper. Yet, they make up one whole unit of Indian Culture.

Shri B. N. Saraswati presented the results of his investigation on distribution of material traits in the 17 districts of Central and Southern Uttar Pradesh. He indicated some of the positive and negative co-relations between such traits as plough, house-type and bullock-cart on the one hand and language and natural environment on the other.

Prof. N. K. Bose indicated some of the important links of Southern and Eastern India with South-East Asia. He also pointed out how areas like Maharashtra and Gujrat which are sandwiched between Northern and Southern India combine in them many of the features typically characteristic of the two zones. Prof. Bose remarked that regional differences are less pronounced on the level of social structure as compared to material traits and that the unity of India is more or less like a pyramidal structure in which there is less and less variation as one rises higher and higher from the level of the strictly material to the level of value system.

Dr. G. S. Puri introduced the argument that cultural similarities between India and South-East Asia are to be explained, mainly, as due to the impact of the Monsoon on both these regions and that finer cultural divisions are based on geological, pedological and historical variations.

Dr. P. Sarkar argued that the super-imposition of too many interpenetrating trait-areas may ultimately present a very confused picture of India as a whole. Some device should be made first of all to identify the core areas of major cultural zones and that qualitative impressions might be quite useful in this matter.

II. MODERN TRENDS IN THE STUDY OF PHYSICAL ANTHROPOLOGY (HUMAN BIOLOGY)

Chairman : DR. P. C. BISWAS.

Dr. Indra Pal Singh advocated the cause of human genetics as follows :—"The Science of Human Genetics has taken great strides in the western countries during the last decade. Many institutes specializing in Human Genetics have been established there, but much attention has not been paid to this important field of research in India. Except a few research workers in Anthropology and medicine, no consolidated and comprehensive effort has been made to undertake research in this field.

Of special significance to our country are two important branches of Human Genetics: Population Genetics and Physiological Genetics. Population genetics deals with the nature of the genetic differences between groups of individuals. In India we find a large number of Mendelian groups which can yield data of value to the geneticist. Various endogamous and exogamous groups have in fact pre-

served Mendelian populations for a number of generations. They not only provide us with a powerful supplement to understand the genetic composition of each group leading to an understanding of their racial likeness or differences, but also help us in understanding the genetic mechanism of various pathological and non-pathological traits.

Physiological genetics is concerned with the problem of how the genes work, i.e., with the definition of the developmental sequence between the presence in an individual of a particular gene and the appearance in that same individual of a particular morphological or biochemical trait. Research in this field can be of great significance in eradicating and preventing disease.

Family planning is being propagated with vigour by the government and non-official agencies. Unfortunately while a great deal of attention is being paid to control the quantity of population, no heed is being given to the control of quality of the population. It is high time that Family Planning measures be adopted by taking eugenical measures also into consideration. I would like to propose the establishment of a national Institute of Human Biology to carry on fundamental as well as applied research on the various branches of human genetics." This was followed by a paper by Dr. S. R. K. Chopra of Chandigarh University on "Growth Studies and their Implications in Human Biology". Briefly, his arguments were as follows:—"In the history of the developmental trends in physical anthropology, Le Gros Clark (1958) refers to a 'romantic phase in which physical anthropologists voiced their opinions (which were more often than not gross exaggerations!) with great confidence. This phase was followed by a second phase where . . . "Standards of evidence were made very much more rigid, particularly with the development of biometric techniques . . ." Since the days of Karl Pearson, who was a pioneer in the introduction of biometric techniques, there has been many reorientation and trends in the study of Physical Anthropology. The writer proposes to discuss only one of the many trends which can be profitably studied in our country.

Growth studies deal with those attributes of living matter which manifest in change in size of an individual, or in number of individuals in a unit environment (Richard, 1934). According to Schultz (1949) for the study of man's evolution the comparative investigations "...have dealt mostly with adults, rather than with the process of growth and development by which the adult form is acquired." The current emphasis, therefore, is to conduct growth studies in the primates in order to elucidate a number of growth process responsible for ultimate differentiation of the structural features in adults. It is also important to understand the significant role played by environment in initiating or retarding growth processes responsible for human variation and human life cycle. Such investigations should record the causes as also the effects of changes in man's structure and function.

From the evolutionary view point and in order to interpret form, pattern and function of the primates including man, growth studies should be conducted both in the pre-natal and post-natal stages of development in order to differentiate between the genetic and mechanical factors responsible for determining the shape of an individual. The bearing of this problem on different branches of science is so intimate that it requires a team of workers to co-operate from such disciplines of science as physical anthropology, anatomy, endocrinology, psycho-physiology and biometry. Growth studies in the primates will throw light on the gradual development and evolution of man through time and space."

Dr. Rife of U.S.A. emphasised that in deriving fruitful conclusions out of genetic studies, it is important to deal with traits which are independently inherited. He presented a mathematical model for studying inheritance of simple mendelian traits by taking into consideration only one parent and one child.

Dr. P. C. Biswas wound up the meeting with the remark that genotypes might be studied even to understand the process of evolution of man.

I. SCOPE, FACILITIES AND MATERIALS OF MEDICAL RESEARCH IN INDIA**Section of Medical & Veterinary Sciences**

Dr. A. K. Hazra, President was in the chair and introduced the subject for discussion.

Dr. Farquharson of the National Research Council of Canada opened the discussion. He described the history of medical research in Canada. Prof. McCallum was the first man to get interested in medical research and started work in micro-chemical studies, but with no facilities. The points raised :

- (1) Stimulus for medical research centres around research minded personalities.
- (2) Universities and institutions to create atmosphere.
- (3) Clinical research is most often neglected.
- (4) When work in a particular line is initiated by a particular interested person, resources seldom lack e.g. discovery of insulin by Banting at Toronto.
- (5) In medical problems, stress and emphasis on fundamental research. In Canada, facilities and materials both are present in satisfactory condition.

(6) Respectable living—proper selection of right man.

Dr. Choudhury (Jabalpur) emphasised the importance of increasing facilities of research in our country. This is not very satisfactory in India. Returns of investment by way of research is not also satisfactory. He also questioned whether the money spent on equipment is properly utilised or not. He also stated that there is lack of co-ordination between the different problems.

He also pleaded for the following :—

- (a) Organisation on team basis and with solution of problem as the aim.
- (b) Improvement of the under-graduate level.
- (c) Better teaching at medical institutes.
- (d) All efforts to improve existing facilities in institutes, instead of opening new institutes.
- (e) Ways and means to stop the "craze" for publication.

Dr. G. L. Sharma (Mukteswar)—The points raised by him were as follows :—

- (a) Organisation to allow continuity of work and research technician.
- (b) Research workers should have no inhibitions about doing any type of work and with own hands.
- (c) Proper type of personnel.

Dr. Balkrishnan (Lucknow) stated that lack of industrialisation of the country is an important factor in the lack of progress of medical research in this country. He clarified his point by stating that simple equipment like dry cell, photo-electric colorimeter, isotopes are not available in this country. So is the case with common spare parts. As a result, the progress in research work in many cases is interfered with.

Dr. A. N. Roy (Calcutta) stated that two factors are very important for proper progress. The first is the selection of proper person and second is a sense of patriotism towards country and work.

Dr. Thomas (Kasauli) emphasised the fact that the utility of medical research is to keep people healthy.

The President, Dr. Hazra, in summing up touched upon the various aspects of this topic.

II. THE VIRUS INFECTION IN MAN AND ANIMAL

Dr. A. K. Hazra, the President of the section of medical and veterinary sciences was in the chair. Prof. N. R. Dhar, General President was also present in the symposia.

In introducing the subject the President said that virology has surpassed the bacterial cause of diseases. Virology has tentacles in biochemistry and biophysics. The knowledge regarding the virus infection in man and in animal is increasing daily. In cases of some virus the knowledge is rapidly increasing whereas in some cases it is almost stationery. Outbreak of virus diseases has helped the virologists to do investigations in this new field. Very few laboratories can tackle virus problem and as such the paucity of virus research in India. He suggested a central organisation to tackle viral problem where all virus collected should be typed and stored. Preparation of suitable vaccine is also another need which needs consideration.

Dr. Thomas (Kasauli) mentioned that very little work has been done on small-pox problem in India. It remained stationery till the days of Jenner. The newer problems like polio is attracting much greater attention. Regarding preservation of vaccine and transport of vaccine, the existing condition reduced the potency to a very low level. The suitable answers are freezing, drying of vaccine, producing the vaccine in eggs and tissue culture. Sheep and rabbit kidney give a high titre of vaccine. The speaker also raised some problems regarding the work of rabbies and epidemiological encephalists.

Dr. Menon (Trivandrum) stated that there should be a central organisation for virus diseases. The Central Laboratory at Poona is not very helpful in this line. Mass immunisation against small-pox is a thing to be taken up by the Government, and a uniform type of vaccine should be produced all over the country. The preparation of suitable type of vaccine in India is of great importance.

Dr. C. M. Singh (Mathura) suggested that techniques of better quality are to be adopted. In virus research the entity of a virus has to be established by pathogenecity. There is no other method to identify the virus. Adaptation of the virus in different tissues might be useful in the production of vaccine. Tissue culture technique can also be adopted for the production of vaccine.

Dr. G. L. Sharma (Izatnagar) stated that many viral diseases in animals are known in India. Rinderpest is the first one which was tackled and the vaccine was extensively used. Suitable investigations are to be done in this field for the preparation of vaccine to combat these diseases.

Dr. Todorovic (Yugoslavia) stated that 15 years ago thousands of cases of Meningitis were seen in that country. But now no case of Meningitis is seen there. Since 30 years no case of small-pox in Yugoslavia was observed. Polio work has also been done. Presence of anti-bodies were tested in the people in that country.

Dr. B. Mukherjee (Lucknow) said that future lies in the chemotherapeutic approach to virus diseases, as has been done in the cases of protozoa, metazoa and bacteria. Large virus are amenable to chemotherapy. Efforts are being made to find out other chemotherapeutic agents which might fight all the viruses. Nucleic acid group of compounds can be used to fight the viruses.

Dr. B. C. Guha (Calcutta) agreed that chemotherapeutic attacks have been very fewer. More work should be done in this line. The main objection is that viruses are simple substances and have primitive form of life. Drugs should be such as to attack only the virus and not the tissue so that it kills the virus but not the man. He cited the example of the use of Amino-pterin which is used in Leukaemia and also toxic for man. Virus and Cancer therefore come in the same group.

Dr. Luktake (Izatnagar) described a new virus disease known as Epivag due to Epidydimitis and vaginitis seen in Africa.

The President Dr. Hazra summed up the discussion and thanked all the participants. General President, Prof. Dhar expressed great appreciation about the

symposia and in general about the section's contribution which he attended more than once.

III. DIET, FERTILITY AND POPULATION CONTROL

(Jointly with Sections of Anthropology & Archaeology and Physiology)

Dr. D. N. Mallick, President of the section of physiology was in the Chair.

Dr. A. K. Hazra (Bombay) opened the discussion by stating that this subject is of great importance to a country like India where diet is insufficient but the population pressure is increasing very rapidly.

Dr. D. N. Mallick (Izatnagar) stressed the need of the appreciation of the relation between land and population. He stated that the population of a country thrives on the land and therefore the fertility of the land has also to be considered.

Dr. P. C. Biswas (Delhi) described some experiments in tribal areas where polyandry is practiced. Here the birth rate is low. In monogamous family 2 children per family but in polyandrous marriage 1.5 is the usual rate. He expressed the view that the experimental evidences are difficult to obtain on this particular problem.

Dr. Kansira emphasised a general biological approach. He stated that the ethical part of birth control is discouraging. There are eugenic involved in it. A good and healthy family should be encouraged to have more children.

Dr. P. G. Pandey (Lucknow) said that the diet must be defined as to have its effects on fertility. For example the effect on fertility of either a well balanced diet very rich diet and deficient diet must be described. He also stated that low inadequate diet reduces fertility and vice versa. In animals deficiency of nutrients affect reproduction and from these evidences some conclusion can be drawn.

Dr. (Miss) Sujata Chowdhury (Delhi) stated that mal-nutrition and bad standard of living in poor areas must also be considered. Education regarding family planning go a long way. It is also essential to divert their mind to different directions.

Dr. S. Banerjee (Bikanir) described animal experiments in which nutrition deficiency reduced fertility. For example he stated that ascorbic acid deficiency and arginine deficiency both reduce fertility in experimental animal.

Dr. Menon (Trivandrum) remarked about the effect of rice diet on fertility, because in Travancore the population is increasing. He also enquired whether coconut oil stimulate hormone secretion.

Dr. K. Bagchi (Calcutta) defined the object of this discussion by stating that diet can affect fertility in either positive or negative way. At present there are two schools of thought in one of which it is stated that mal-nutrition increases fertility whereas the general mass of opinion is in favour of mal-nutrition reducing fertility. These evidences were described and conclusion drawn that mal-nutrition as a result of a consumption of defective diet reduces fertility. He also cited figures from the latest census report and stated that contrary to the general opinion the birth rate and children to the mother ratio in different parts of India showed that these figures are high in the northern and central parts of India where the people are well nourished whereas the figures are low in the southern and eastern parts of India where mal-nutrition is widely prevalent. From these evidences it can be concluded that there is no reason for supposing that mal-nutrition has a direct effect on the increase of fertility.

Dr. D. N. Mallick (Izatnagar) is summing up mentioned the importance of the subject. He stressed the fact that more work should be done on this line so that suitable planning should be done to control the problem of population pressure.

I. THE RELATION BETWEEN SOIL CONDITION AND PLANT GROWTH

Section of Agricultural Sciences

Chairman : DR. B. L. CHONA.

1. DR. S. P. RAYCHAUDHURI (New Delhi).

We should carry out more intensive work on the nutrition. At present work is being carried out in isolation generally by the soil chemists and the plant physiologists—the soil chemists carrying out soil analysis for determining the major nutrient while the plant physiologists carrying out plant nutrition work in water or sand cultures generally. An integrated approach is necessary. One basis of approach from the point of soil scientists would be the basic soil regions differentiated on the basis of geology, vegetation, topography, and climate. There are five soil forming factors viz. geology, vegetation, rainfall and topographical maps of India. If these maps are drawn on translucent papers and superimposed on one another these regions showing similar geology, vegetation, rainfall and topography may be demarcated. The regions thus differentiated are known as basic soil factors which may be major or minor depending on the differences in the above factors on the basis of which the soil regions are demarcated. In addition knowledge of erosion of the soil is very necessary for growing plants—either of cereal or first plantations. Thus red soil which used to grow good teak, after degeneration growing trees, and the soil when further degenerated grows *dhak* trees and lower species of vegetation. It is suggested therefore that definite plans should be recommended and drawn up.

2. DR. R. S. GUPTA (Dehra Dun).

In considering soil conditions in relation to plant growth, we have to consider not only soil type as such but also other factors such as (i) moisture conditions *in situ* (ii) site factors such as slope and aspect and (iii) arrangement of horizons in the profile. A very clear evidence of this is seen in the study of forest soils in relation to forest growth. We have specific data on Himalayan soils, Laterite and Red soils of S. India with reference to teak growth, *Casuarina* soils (of Puri, Sriharikota, Padgai plantation on banks of Cavery) and Sal (*Shorea robusta*) soils of U.P., M.P. and Behar. In the case of Himalayan soils it is found that while we have podsollic soil formations under conifers, there is mostly brown-forest-soil formation under broad-leaved species like oak. In the case of laterite and red soils in the teak forest of S. India, a very interesting relation has been similarly found. We can now actually give a forecast of the quality of teak that can be obtained on the basis of (a) laterisation ($\text{SiO}_2/\text{R}_2\text{O}_3$ ratio) moisture factor (actually mathematically calculated) aspect and slope, thus saving lots of labour and money that was not possible before. Relation of moisture and arrangement of horizons is very interestingly brought out in the case of work on *Casuarina* soils. It has been found that mass scale failure of this important forest species can be controlled by regulating moisture regime. In case of areas where *Casuarina* is failing there is a layer of sand on top of water table which does not allow moisture to feed the roots of plants, which it is the reverse in case of areas with healthy growth of *Casuarina*.

3. DR. J. J. CHINYOY (Ahmedabad).

The problem can be looked at from two angles (1) soil study and (2) study of the plant.

In the first instance reviewing the work of soil analysis it cannot be of much use from the point of view of major nutrients of the plant on account of the considerable heterogeneity of the soil. In the case of trace elements soil analysis becomes still problematic on account of the extremely low concentration of these nutrients. As regards determining the nitrogen status of the soil the effort is not very fruitful because the form and concentration of nitrogen compounds of the soil are very dynamic. In the study of problems relating to the problems of alkalinity and salinity of the soil as well as for soil erosion studies of soil analysis may prove useful.

Coming to the study of the plant different factors affecting crop production can be considered under four heads: (1) nutrition, (2) water requirement, (3) environmental requirement (sowing data), (4) space requirement. The most important fact to remember in this connection is the existence of interaction between these factors and no work on crop plants can lead to useful and practical conclusions unless the major, interactions of these factors are studied. Thus for instance even under adequate supply of nutrients and water these may not be profitably utilized by the plant for crop production unless the time of sowing and spacing are at optimum levels.

Considering the suggestion of preparing vegetation-soil-climate maps by surveys for superimposition on each other to obtain useful information it should be noted that considerable work on correlations between growth and development of a crop plant and its environmental requirement of which temperature and light are the most important. Only very detailed and sustained studies in developmental physiology of this nature can give reliable data from which generalizations in the form of a formula expressing the relationship between plant growth and development on the one hand and its environmental requirement on the other can be worked out. As an illustration of the usefulness of such a work the example of the determination of phototheramine quanta for wheat varieties can be cited.

Finally two other aspects of plant work may be mentioned. Firstly the question of varietal response to nutrients can best be solved by determining the correlations between nutrient uptake and developmental process are correlated. Secondly in the case of fighting the alkalinity and salinity of the soil pre-treatments of seeds have proved useful and they should be taken into account.

4. DR. U. N. CHATTERJEE (Gorakhpur).

The study of soils may be undertaken from different points of views. The points of view from which the agricultural scientist studies the soil is very different from those of the forester. In forests there is a persistent undergrowth covering the soil surface. It is therefore not proper to devote attention only to the trees growing thereon. The nature of the soil will be determined more by the effects of undergrowth vegetation than by tree growth. The soil is a living system of various complexes including the factorial complex represented by various micro-organisms. In such a system any major change of pH value brought about by the falling and decomposing leaves is not very easily possible. In agricultural soil the question of undergrowth does not arise, because in agricultural practice the competition between the required crop and any other vegetative growth is sought to be reduced to the minimum.

The mere chemical analysis of a soil and finding the quantities of various nutritive factors present will not help much. The absorption of various nutritive factors does depend on the prevailing environmental factors. The mere presence of a particular factor, major or minor, does not suggest its ready availability to plants.

The water-holding capacity of a loamy soil is due to the various colloidal complexes present therein. If there is a sandy layer below abutting on the water table, it is more reasonable to suppose that water will rise because of the existing capillary complexes.

5. DR. G. S. PURI (Allahabad).

Indian conditions are peculiar in two ways, geology and climate. There are well defined geological horizon, notably limestone of the outer Himalayas, alluvial deposit of the Indo-gangetic plains, Basalt and crystalline rocks of the Deccan. Each type of geological formation has given distinct soil types and plant growths. Indian climate is monsoon—i.e. alternately wet and dry when soil development trend is respectively leaching and evaporation. Leaching promotes podsolisation and laterisation and consequently soils under these conditions bear calcifuge species and communities of plants where the trend is evaporation azonal soils develop with high amounts of bases on the surface. Here a calcicole vegetation develops.

Succession of plant communities is preceded by edaphic succession. The relationship between plant and soil is a very close one and linear position or negative relationship between plant growth, distribution or development has been found with various factors of the soil complex, such as pH, N, P, Bases, trace elements, moisture etc.

6. DR. G. V. CHALLAM (New Delhi).

While discussing about the role of soil nutrients in relation to plant growth varietal differences of different crops have to be taken into consideration. The breeding of Japonica $\times$ Indica hybrids in Rice may be taken as an example in the case of response for heavy manuring. In the breeding programme of Japonica $\times$ Indica that was carried for the last ten years in Orissa it was found that the response to different levels of nitrogen in the racial species to be different. The Japonica varieties responded under high levels of nitrogen in contrast to the indica varieties. Many of the hybrids were found to be intermediate in response. The response was tested by methyl-amine test the time of heading. Later quantitative studies were made where the absorption of nitrogen was higher in the indica varieties in the initial stages while in the japonica varieties it was in the later stages.

7. DR. JASWANT SING (Banaras).

For proper understanding of the subject of relationship between soil and plant it would be necessary on the one hand to have comprehensive approach to the study soil in regard to its geological origin, fertility status, moisture, aspect and other conditions which influence its productive capacity and on the other to look at the plant not only from its nutritional aspects but also ecological, genetic set up, and nature of its response to agronomic treatments of soil. This relationship operates both ways. It is, however, worth keeping in mind that often one particular factor or condition may become so dominant as to shadow others or it may become a limiting factor and thus restrict the effect of other factors. The problem needs coordinated team-work of not only soil scientist and plant physiologist but other experts also like the plant breeder, biochemist, and farm management specialist.

8. DR. M. R. MADHOK (Dehradun).

My own feeling is that the type of microorganisms that grow in the Rhizosphere has great effect on the availability of nutrients from the soil—the production of hormones and the nutritive value of crops.

9. DR. D. B. REDDY (New Delhi).

There must be a coordinated approach to the problem. Factors responsible for the good growth of plants should be studied in all aspects and the recommendations made should be foolproof, so that cultivators can practise the recommendation and the extension workers go ahead with confidence.

Boron for example need not be sprayed on a cauliflower or other crop where farmyard manure or compost has been used. Similarly sulphate containing fertilizers should not be used in soils which are ill drained especially in low lying areas. There is a direct relationship between the water table and citrus growth; higher the water table, more than adverse effects on citrus plantations.

I suggest that integrated study may be made of all the factors-creating plant nutrition laboratories and engaging plant nutrition experts.

10. DR. S. N. BHARADWAJ (Coimbatore).

The problem of Soil Salinity is exceedingly important in tropical agriculture and needs active collaboration of Soil Scientists and Plant Physiologists. The authors' working on the problem of soil salinity at Botany Department, Agra College, Agra observed a positive correlation between the degree of salinity and crop growth. Also, crop growth on moderately and low Saline Soils could be improved by presowing soaking the seeds in dilute solutions of NaCl, the predominant salt in saline areas. Dr. M. N. Sarin from the same institution observed that presowing soaking the seeds in I.A.A. or spraying the same could increase the yields in saline soils rich in sodium sulphate.

11. DR. SÂDGOPAL (New Delhi).

It was pointed out that according to the expert opinions of workers engaged in different branches of sciences, the great complexity of the relation between soil condition and Plant growth had become all the more vivid and baffling. Besides the well recognized factors of soil and soil nutrients, climate, vegetation, aspects etc. known to affect the plant growth. It has been shown that factors like the time of sowing, spacing between the plants do also contributed largely towards it. Consequently it had become obvious to rule out any single and individual line of attack at a personal level to unravel the great and fascinating mysteries of plant growth. This was all the more important in case of economic plants e.g. medicinal and aromatic plants whose economic rating was primarily dependent on certain active constituents like the alkaloids and terpenoids. Typical cases to establish the complexity of the problem were explained as follows:—

(i) Plants of *Veteveria zizaniodes* Linn. (Nash.) occurring naturally in Northern India give an essential oil which is invariably rich in optically active sesquiterpene alcohol and ketones of laevorotatory character; while the same plants cultivated in Malabar and Travancore gave, on the contrary, an oil rich in dextro-rotatory constituents. Plants from northern India were transplanted in Malabar and Travancore and those from the latter areas in Northern India. After long stay in the local conditions and soils, they have been found to completely accli-

matize themselves and behaved exactly like those normally found in those respective areas.

(ii) Plants of *Mentha Spp.* grown in Jammu and Srinagar have shown great differences not only in their yields of volatile but also in the contents of Menthol and Menthone and in some cases even behaved better than the parent stock plants in their mother land.

(iii) Plants of *Pelorgomissa* grown in two different aspects in Yercand Hills showed marked differences in their oil yield and its quality.

(iv) Plants of *Cynhopagon martinic* growing in the same area but separated by a road in between showed almost opposite behaviour in their yield and chemical constituents of the oil.

(v) Plants of *Acacia catechu* collected and examined from all over India varied very much in their yield of catechin from 0.1 per cent to 4.8 per cent.

Such examples could be multiplied to convincingly prove that no one and single scientific approach could explain these complexities of plant life. What was needed therefore was evolving a suitable set-up of an intensive attack on the problem through a well directed and coordinated team of scientist drawn from different branches of science to yield effective results in a most economical and rational manner. Examples of successful team work accomplished in Israel, France and Australia are well known. Claims have been made to condition and tailor the soil to aid maximum plant growth and development of economic constituents. India should take a bold step in this direction.

12. DR. B. N. SAHU (Bhubaneswar).

Soil structure plays an important part in influencing plant growth. Experiments carried out at the State Research Station, Bhubaneswar have shown that in case of *Rauwolfia* deep-ploughing and incorporation organic matter and periodical cultivation have increased yield of root and serpentina content. The incorporation of Organic matter on growing of grass and its ploughing up have brought about crumb and granular structure. Such a structure has improved drainage, and aeration and biological activities which have increased the yield of roots. In case of rice ploughing just after harvest of the Crop followed by subsequent ploughing one in each month till sowing has given better tillering, greater height in growth, more effective tillers and finally higher yield than keeping the plot unploughed and fallow till sowing or puddling just before transplantation. Ploughing every month has resulted in better structure of soil than ploughing just before sowing on puddling before transplantation.

Dr. Raychaudhuri concluded by saying that the various points of view point formed by the different speakers leads to the conclusion that an integrated approach of study in the important problem of soil conditions and plant growth is not being followed in their countries. In this growth is not being followed in this country. In this connection he referred to the publication of Sir E. John Russell on "Soil conditions and Plant Growth" and stated that the various aspects of problem mentioned by the different speakers were all included in that important publication which is considered to be a dictionary on the subject. He stated that there is lot of scattered information on different aspects under Indian condition on the subject in published papers and unpublished reports and suggested that all these informations should be collected and compiled under the aegis of I. C. A. R. and also the work on the relation between soil condition and plant growth be intensified.

II. INSECTS IN RELATION TO AGRICULTURE

Chairman : DR. B. L. CHONI.

1. DR. S. M. SINGH (Saharanpur).

The pest of major importance on mango are the hoppers and the mealy bugs. For controlling the hoppers we have a general practice of applying 0.125% DDT, but it appears that the application of DDT is upsetting the balance of nature in regards to parasites and predator status of a pest. In absence of these parasites other injurious organisms viz. mites etc. have increased greatly. The malformation disease of mango appears to be the effect of this insect. It is, therefore, suggested that it should be replaced with diazinon which proves effective against hoppers, mango mealy bugs and is also effective against mites.

For the control of citrus Psylla, a major pest of citrus in Western Uttar Pradesh and in the Punjab, application of 0.1% endrin against the nymphs and 0.1% Parathion, 0.5% BHC against the adults gives 95 to 98% kill.

2. DR. C. S. R. MOORTY (Bangalore).

It must be noted that cultivation of crops in contiguous areas also upsets the vegetation balance and provides avenues for the multiplication of specific parasitic feeders. Therefore, there is also a need to restrict such parasites as long as crops have to grown for mankind. For spraying mango a sulfur-insecticide combination is preferable to direct application of DDT alone. More attention should be paid to control of insect and fungal disease problems in a co-ordinated and integrated manner rather than as isolated entomological and pathological problems. As example, the control of vector with insecticides will prevent virus diseases for spreading and thus reduce losses in crop production.

3. DR. T. G. VAZIRANI.

Metcalf and Hint in destructive and useful insects have discussed the relative knock down values of different insecticides and have shown that aldrin, dieldrin and endrin as possessing relatively high values. It is quite important to know the exact identity, number and time of application of insecticides with reference to toxicity is also important. Importance of biological control e.g. control of mites by lady bird beetles and of other pests should not be lost sight of.

4. DR. S. S. JAIN.

Insects besides causing damage directly act as vectors and carriers of several fungal and bacterial diseases. Several virus diseases of tomato, capsicum and potato are spread by insects. Similarly, sooty mould of sugarcane, mango, citrus and other crops have been observed where insects had been present and secreted honey dew and these sooty moulds interfere in the normal photosynthetic activity of the plants. Likewise, incidence of citrus canker has been observed to be high in orchards with a greater infestation of leaf-miners. In the case of tomato and brinjal, fruit borers serve as avenues for the entrance of fungal spores and bacteria, thereby causing fruit rots.

In view of the above the following two suggestions are made :

1. Nursery beds, particularly, of tomato, capsicum, etc., should be regularly sprayed with insecticides to keep the nursery plants free from virus infestation

and consequent increased spread in the field. This aspect is generally overlooked in our country.

2. Insect population should be kept down in the orchard crops like mango, citrus, guava etc., by spraying the crops with insecticides as an indirect measure of control of disease like sooty moulds, citrus canker, etc.; since prevention is better than cure.

5. DR. G. S. PURI (Allahabad).

Insects are extremely important in plant life generally. There are insects that in pollination and but for these seeds of many-species would not set in. Then there are harmful insects like locusts, beetles, etc., that adversely affect not only agriculture but all sorts of plants.

One insect *Haploceramyle* causes a vere serious damage to trees of *shorea robusta*. These have been a large number of epidermis caused by Haplo in Sal forests of India. The wholesale destruction of Sal tree from the area affects forests succession, converting high forests into scrublands or to grasslands. There are other cases of harmful insects in forestry in different parts of the country, which bring about tremendous losses of timber.

III. PLANT DISEASES AND METHOD OF THEIR CONTROL

Chairman : DR. B. L. CHONA.

1. DR. S. S. JAIN (Solan).

Stress on the following aspects of Plant disease control should be laid in view of the ignorance and chiefly the poverty of the Indian cultivators to afford costly equipment and materials in following the schedule of chemical applications.

1. Raising disease—free nurseries for seed requirements, small areas can be kept apart for this purpose where thorough and strict observations can be made and roguing and other operations can be carried out without much difficulty. This would enable every cultivator to have disease-free seed for his own requirements.

2. Stress was laid on roguing operations which would not cost the cultivator much and at the same time keep his crops free.

3. Cultural practices like changing the sowing date, rotations etc. need be popularised among the growers.

4. Inspection and certification of fruit nurseries is essential to prevent spread of virus and bacterial diseases like hairy root. Besides testing of progeny plants is all the more necessary to detect latent viruses.

Besides, the need of more rigorous inspection, quarantine and testing for freedom from viruses of horticultural planting propagating material imported from abroad was stressed, since large importations are being made annually with the rapid development of Horticulture in our country, and fortunately many serious virus diseases which are present and causing enormous losses in foreign countries are not present in their country, hence it is imperative that no viruses are allowed to find entry in our country.

2. DR. JASWANT SINGH (Banaras).

For successful adoption of plant protection measures for control of plant diseases it would desirable for plant protection experts to formulate suitable

schedules for particular crops. In the matter of making recommendations like shifting of dates of sowing with the object of enabling the crop to escape the attack of a disease it should be done after taking into considerations other relevant factors like availability of irrigation of water between the competing crops and the like.

3. DR. I. N. TANDON (Saharanpur).

Experiments for the control of plant disease should be laid out on the cultivator's field in order to convince the cultivators regarding the efficacy of the treatment.

4. DR. S. C. SEN (Kanpur).

Application of balanced food in the right proportion of N & P_2O_5 would help in affecting the plant crop from diseases. Under water culture studies, it has been proved by Sen that the balanced food for sugarcane crop is 3:1 (N: P_2O_5), when the manures in the form of organic and inorganic form the affection of the crop is comparatively lesser than either the control or the plot having manured with nitrogen.

I. PHYSIOLOGY OF PREGNANCY

Section of Physiology

Chairman : DR. D. N. MULLICK.

Dr. D. P. Sadhu opened the symposium. He discussed the role of different endocrines in influencing the pregnancy and he also dealt with the mechanism of conception. He also discussed the interrelationship between heat and ovulation.

Dr. Luktuke discussed the occupation of gestational oestrous in bovines, which is not normal. He discussed its importance in artificial insemination.

Dr. Bagchi discussed the ascorbic acid metabolism in pregnancy and lactation. Pregnant women on low ascorbic acid diet were found to have no signs of deficiency on clinical and laboratory examination. He discussed the possibility of synthesis of ascorbic acid in the placenta or the foetus, or else it may be just storing it.

Dr. D. N. Mullick showed that urinary excretion of ascorbic acid, aneurin and nicotinic acid increase as pregnancy progresses even in a constant diet. Dr. M. C. Nath made the suggestion of studying the ascorbic acid synthesis by labelled glucose.

Prof. Sharma discussed that ascorbic acid deficiency hinders the healing of wounds and it does not interfere with the regeneration of endometrium during normal menstruation.

Dr. S. P. Sharma discussed the causes of sterility in animals and their treatment as investigated by the regional sterility centres. He emphasised the importance of phosphorous and iodine in the diet and also discussed the role of vitamin C in fertility and libido.

Dr. D. N. Mullick demonstrated the calcification of a deciduous tooth during the gestation period and during childhood by a microphotograph.

There was a lively discussion in which many workers participated.

I. CONCEPT OF CRIME AETIOLOGY AND PREVENTION

Section of Psychology & Educational Sciences

Chairman : DR. N. MUKERJI, Bombay.

1. NIRMAL KUMAR BOSE (Calcutta) : *Crime : Its origins.*

A social scientist like an anthropologist looks at crime in a slightly different way than is customary among such officers of the Government as are entrusted with the responsibility of preventing crime or punishing criminals.

From the point of view of the sociologist, crimes can be roughly divided into two classes in accordance with the nature of their origin. Let us try to use concrete examples as that helps in clearer thinking. There are many homes in India today oppressed by poverty and all its consequences. There is overcrowding, a shortage of food, and frequently the mother who has to look after the younger children is herself so deeply oppressed by the circumstances of life that she becomes cruel at moments and treats her children unkindly. In many such homes, the father does not wish to return from work as long as he possibly can, because the home is a place where there are many unfulfilled responsibilities. It is not a place where one seeks refuge. So he also passes as much of his time and leisure as he can outside. If he returns home, the oppression of poverty and the demands made upon him by members of his family either make him harsh or neglectful of his duties as husband and father. When there are many homes of this kind, children feel the harshness of their domestic surroundings and band among themselves in order to help one another 'spiritually'.

When life is cruel all around, two things may happen to a child. It can either take refuge in imaginary happiness of various kinds or if he is assertive he may fling back the harshness which oppresses him on to those who are in apparent enjoyment of happiness.

Delinquency or crimes may thus originate from the privacy of one's personal history. Of course, in the last analysis, such crimes are also of 'social' origin. The conditions of society are either directly or indirectly responsible for the individual's suffering. But there is one thing which distinguishes these crimes of individual origin from those to which reference will now be made and which, in our scheme, belong to the second category. This distinction lies in the fact that even while a child becomes criminal under the circumstances described above, his actions are socially recognized as criminal. They are breaches of established rules or even of law. The person who commits such crimes knows that this is something which has the serious disapproval of members of society around him.

The second class of crimes, however, is of a different nature. Let us try to be concrete once more. In war between nations, it is considered right and proper to kill some one in the enemy camp. One can recall the utterance of the Prime Minister of England during the second world war in which he said of the Nazis that he would 'bleed and burn them to death'. Nobody questioned the propriety or even the morality of such an utterance or of the step contemplated; for in war it is considered necessary to punish the enemy in the most economical manner possible. Perhaps it was on this account that the first atom bomb used for killing men, was employed by the world's first democratic power, because it was calculated to bring the second world war to a swift close, and thus prevent a long-drawn war in which chances of loss of life, in the sum, was likely to be much greater.

There are moments in the history of a community, whether it is a nation like France or Germany, America or the U.S.S.R., or Hindu and Muslim, when

killing is not only condoned, but even considered virtuous, although it is admitted that it is virtue not in the strictly moral and personal sense of the term, but a virtue which grows out of the inevitableness of circumstances.

In personal life killing is looked upon as crime except when one does so in self-defence. When communities are concerned, killing is also considered to be virtue if it is for self-defence. A nation might defend its possessions or try to maintain the safety of its future generations or maintain the standard of life which it has somehow succeeded in establishing for itself. And under the urgency of self-defence, what is personally reprehensible becomes collectively desirable. The sin of killing is watered down until it is not recognized as crime.

The second class of crime to which we made a reference previously belongs to this category. It is wholly of social origin and it affects the individual in such a manner that the system of values which he cherishes in personal life is put in cold storage and replaced by others under a sense of fear or threat to one's security. It has been the experience, particularly after the partition of India, when India went through a civil war in which Hindus were ranged against Muslims, that even when the battle is over some of the values which were lost or temporarily suspended, refused to be restored when the war came to an end. There is a spill-over of the values, which are considered good in battle, good in an age of conflict, on to the age of peace. What was heroic under one context refuses to submit to social control easily and remains as a source of crime in the subsequent phase. This has been our experience in India where we are reaping part of the harvest of what was sown during the war of independence.

In brief, therefore, crimes as we see them can be divided into two classes, namely, (i) those which are primarily of personal origin in which the criminal nature of an act is always recognized, and (ii) those which are of social origin in which values current in personal life are suspended during threat to the security of a community's life, and what is crime in personal life is looked upon as heroic for the time being. Later on, by a back-wash, such a suspension of primary values yields its own harvest of crime.

As crimes are thus of two kinds, their prevention can also perhaps be brought about by two different procedures. Of course, the overall procedure will be to set social matters right, which is naturally a single task. If society can so organize production and distribution that all men are able to enjoy the fruits of their labour, then many of the things which result from poverty, overcrowding, etc. are likely to disappear. If one single community does not try to achieve such a condition within its own small sphere but tries to do so on a world-wide scale in which no community is looked upon as alien, then many of the symptoms which today appear in the conflict of nations will also tend to disappear. But if in a Science Congress we formulate such a recommendation, then we would be accused of recommending the impossible. We shall, therefore, try to be more humble and suggest briefly a few steps for the prevention of crimes originating from both the circumstances referred to above.

In the words of the Buddha, something which is undesirable can only be overcome by its opposite. If there is cruelty or selfishness, the only way to overcome it is through the promotion of their opposites. In dealing with crimes which originate from personal history or poverty and harshness, the reasonable way seems to be to promote kindness and the creation of a condition in which the harshness of poverty can be overcome. It might seem almost like the advice of a benevolent missionary, but personally, I believe, one of the ways of achieving this result lies within the function of a psychologist. One who is subjected to harshness, suffers intensely from it and becomes frustrated and bitter in life, may perhaps be helped spiritually to take a different attitude. Instead of giving up the battle, a person may be helped to take a different view of the situation and

try to recover one's peace of mind and retain the energy to fight against heavy odds. If so, at least a part of the battle is won.

As regards the prevention of war, I believe, the problem is of dimensions lying beyond the scope of an ordinary scientist. Yet one may perhaps venture to say that war can also have its substitute. William James, the celebrated psychologist, once wrote about a moral equivalent of war in which he proposed that men should be encouraged to struggle collectively against nature in order to wrest from it materials for the satisfaction of the needs of life; and then they might be prevented from wasting a large part of their energy in mutual struggle. Nobody has taken that advice for the last fifty years. When there is a shortage of goods available to a community and there is not enough for everyone to go round, competition becomes inevitable. But the competition need not necessarily be in terms of war or violence in which punishment is hurled upon the enemy in order to bring him under the subjugation of one's will. There is possibly a different way for achieving the same result. This is the way of struggle without the use of violence. If the new technique can be perfected and progressively greater use made of it in social conflicts, one day humanity may reach a position when conflict will not be banned, but conflict of a violent nature will be banned. If we succeed in achieving this, then crimes which come as a back-wash of wars will also become less and less until humanity begins to breathe a little more freely within an atmosphere of human brotherhood.

It has to be admitted that none of the above procedures of prevention seem to be likely easy open roads. I believe it is improper to give a false feeling of assurance that everything will be all right when there is no justification for such a feeling.

2. PROF. K. M. KAPADIA (Bombay).

The Government of India looked upon members of some tribes and castes as born criminals. This attitude was reflected in the Government's dealings with them and resulted in abetting these people to be steeped into crime. This concept of born offender has now been corrected with the growing realisation that the influence of environment is more assertive and more amenable to fixation and definition with respect to its role in the etiology of crime.

Economic drive is seen to be operative in cases of petty thefts where the alleged criminals lost their hereditary occupation on the advent of new economy. The increasing number of suicides by women can also be linked with the economic factor. Risley has referred to this economic burden that the female child proves to be, as one of the motives of female infanticide in India. The majority of the juvenile delinquents also suffer from poor home conditions. Economic incentives to crime are, however, limited in their operation. Poverty per se is not the main inductive factor to crime. It gives rise to various situations which are conducive to land immature minds into antisocial activities.

The most vital factor in the genesis of crime is the family. Poverty creates situations in which children are constrained to seek substitute satisfactions or relaxation outside the home in streets where they are exposed to influences emanating both from persons and conditions, which they fail to encounter successfully. The child feels rejected and insecure and craves for companionship, recognition and excitement in a home where both the parents are working, and takes recourse to delinquency.

The factors that are mainly responsible for a large number of suicide cases by women reveal various types of strains in the family relationships, arising out of sterility or birth of only female children, or dissatisfaction of the husband's family with the amount of dowry given. The woman represses all her mental

conflicts so long as she can, but when the repressed feelings give rise to high-pitched tensions she commits suicide. The strains in the family can also be interpreted in another way—broken homes which are more common among the lower strata of Indian society. The child is often found to leave the home which neither evokes in him emotional response nor provides him with emotional and psychological moorings. The families of the alleged criminal tribes and castes provide still different patterns of interpersonal relationships. The parents not only fail to provide a sound moral foundation and healthy channel of socialisation for the children but on the contrary stimulate immoral and antisocial tendencies, by precept and by preaching.

The role of economic condition, family, education, social values, etc. has now been properly understood. What is not yet appreciated is the fact that every person stands for self-respect and his individuality is hurt when he is made to feel that he does not deserve it. A number of cases are now on record that criminals' responsive chords can be evoked by treating them as no worse than any other human being. It is the faith in the man that he is dependable, the human touch in dealings with him and the personal interest in their affairs and strains of life that go a long way in making them good citizens.

3. PROF. S. JALOTA (Chandigarh).

The term *crime* has primarily a legal connotation. But it has such an extensive denotation that one is tempted to turn towards its possible psychological implications. Usually the law of a land indicates the extent and limitations of the *rights* of individuals as well as of society, under various circumstances. When one individual offends the rights of another person or party, he is accused of committing a 'crime'. A really serious offence is immediately recognised by the society, and the officers in charge of law and order are empowered to take necessary steps to protect that society and to restrain or punish the offender.

From the point of view of the individual's psychological make-up, the criminal is one who is oblivious of the rights of others. It may be he transgresses in ignorance, or he does trespass with deliberate intent. Again, it may be a temporary or a relatively permanent attitude. The problem for psychology is, why does the criminal violate another's right.

In the case of *deliberate crimes*, there are the following possibilities :

- (a) he considers his own rights to have an over-riding value; e.g. my need is greater than thine; or
- (b) he has been wronged and has the right of revenge, the other person has simply lost all rights, e.g. 'badhyo'si me', or
- (c) the others rights are idle fancies and not based on fact, or
- (d) he is incapable of considering another's rights.

Among these cases, the deliberation is of a higher order and more complex in character in the case of (a), but it progressively deteriorates in cases of (b), (c) & (d). Indeed, one may suspect that (d) above, when a person has never considered another's rights, is hardly a case of a crime. It is an amoral reaction or reflex.

In the case of *non-deliberate crimes*, the action is due to some accident of malfunction, as in road-accidents; or it may be due to a temporary excess of emotion. In the case of a recidivist, when the crime is repeated the said individual may be suspected of a *weakness of the moral fibre*. They are at times suspected of being psycho-pathic types of deviated personalities, or psycho-pathic deviates.

If we accept the above description, then it follows that the prevention of crime is possible only upon the development of a strong regard for the rights of others—the attitude of Sir Phillip Sidney 'thy need is greater than mine'. It has also a *negative* aspect, the training in self-sacrifice, the development of an

ascetic pride in disregard for individual satisfaction: "I can rough it better than you". Such training should begin early, be frequently repeated and be sustained by some constant, invariable higher ideal.

Correction by restraint or punishment is usually ineffective, in the long run. A change of attitude, through re-education, psychotherapy, etc. is likely to succeed in the case of offence; when the offences are the result of deliberation of the type (a) or (b) cited above. There is a different recognition about the accuracy or a distortion of the aim.

In the cases of crimes of emotional intensity, or accidental lack of control, the need for caution and self-control is to be kept before the individual with considerable frequency. In the case of emotionality due to unconscious complexes, adequate psychotherapy is indicated.

In the case of hardened criminals, a regard for another's rights may be evoked through a definite shock of virtuous behaviour as illustrated in instances of religious conversion.

4. SHRI K. F. RUSTOMJI (Bhopal).

A study of human society will inevitably lead to the conclusion that there is a continuous process of growth and decay. Recent studies in physics and mathematics have shown that there is a constant trend from equilibrium to disequilibrium, or to apply that reasoning to society, from order to disorder and back to order.

Criminality is present in a vestigial form in every human being but is kept in check by the socializing influences of the world. There may be some individuals who are always in danger of a breakdown to criminality because of certain defects in them, but in general, environment plays an important part in keeping men socialized, and in preventing the criminal propensities from developing. Environment includes the mental and philosophic basis of human development, apart from economic, and sociological factors directly related to crime.

In every society there is a constant struggle between the desire to stay socialized at a certain level, and the desire to improve conditions by desocializing and building up a new society. This is the dilemma of our times, particularly in the under-developed countries, which is reflected in an increase in crime and the inability of States to deal with it.

In the international sphere too, the principles of socialization will have to be applied if we want to avert the crimes of one country against another. We have not yet been able to evolve a method of living together, although the distances that separated men have been narrowed down, and we have begun the process of international socialization with principles such as those which have inspired "Panchsheel". The plain fact is that unless we can control crime in the international sphere, there will be no civilization left. Yet the process of controlling war depends on the same principles as those which have been laboriously built up over thousands of years by men to save themselves from crime by individuals and groups.

5. DR. D. GANGULY (Calcutta).

Crime is a socio-legal term. There had been some tribes in India which were labelled as criminal tribes. The economic condition of particular communities of these tribes were much below par with the surrounding communities outside the tribes. The incidence of criminal behaviour committed by the individual of such tribes, is but an attempt to raise economic advantage of the individual. It

is not infrequent that the members of these tribes were instigated to commit lifting of articles or theft on a bait of cash which was so low as to leave a profitable margin for the exploiters who would sell them in a market for second-hand articles. The remedy for such anti-social activities, then, very obviously lies in the economic upliftment of such tribes.

Crime is also viewed as a patho-psychological condition where the committing agent is adjudged as a suffering individual from personality mal-adjustments. In him, it is supposed that 'super-ego' has not been formed of that strength which would keep him within the bounds of social codes. A study of his environment and personality make-up suggests a recipe for individual correction. For controlling incidents of such anti-social behaviour, it naturally follows from above that the individuals should be nurtured in a way for all-round healthy development.

The prevention aspect of such anti-social behaviour has not received much attention except attending the individual cases with correctional measures fitting to particular occasions. For a far-reaching and lasting result in the solution of this colossal social problem a restructuring of the social fabrics is envisaged where individual personalities would receive same amount of importance in the social eye and would meet similar environmental conditions. Doubts have been expressed as to whether criminality can at all be totally eradicated from the body of the society. The hypothesis stated above has not been put to test seriously and with sufficient scientific meticulousness. So the doubts against the hypothesis have not yet gained in strength so as to rule out the hypothesis from practice.

6. SRI S. BHATTACHARJI (Calcutta).

To understand crime in its proper perspective we must not depend much on the data obtained by studying the criminals as a whole. On the other hand the different types of criminals are to be considered separately. As the motivating factors are not same for all types of crime. Consequently the aetiology of different types of crime will also differ. The nature of criminality is dependent upon :—

- (1) Socio-economic factors, including cultural factors.
- (2) Hereditary factors
- (3) Interpersonal factors
- (4) Biological factors
- (5) Other factors like Psychosis, Epilepsy, Mental deficiency, etc.

As regards the extrinsic causative factors of crimes, they can be controlled, but the intrinsic factors like heredity, etc., will always remain uncontrolled. Recently some reports have been obtained that by medicinal therapy, Glandular operation, etc., some of the habitual sex offenders have been cured. This is, however, only possible in the cases of pathological sex offenders.

There are correctional institutions, which deal with the criminals after the crime has been committed. But we must look forward for such measures which will throw light on the preventive aspect, i.e., total suspension of criminal activities.

Unfortunately no singular factor has been found responsible for the causation of crime and as such more and more research in this field is extremely necessary. Prevention of crime can also be enhanced if the criminals are properly rehabilitated after they have been sentenced and sent to jails. Statistics as regards the incidence of crime is not at all comprehensive, unless we know how many crimes are committed by habitual criminals and how many by casual offenders. The number of habitual criminals can be minimised by proper rehabilitation and the rehabilitative measure is possible by properly training and re-educating the criminals inside the jails. A large number of criminals inside the jails can be utilised, if they are trained to some suitable vocation, according to their aptitude of capabilities determined by Psychological testing. This procedure of properly

placing the criminals for suitable vocation, when inside the prison, enables themselves to release their emotional tension (due to imprisonment) to a great extent and ultimately the procedure becomes a rehabilitative measure of the criminals.

The Reception Centre attached to Alipore Central Jail is the only such Centre in India working in the line mentioned above, and desired results have been obtained.

This type of Psychological Centres should be opened in every jail and there by this will not only help the prevention of crime, but also this helps to maintain a peaceful and model atmosphere inside the jail.

II. PSYCHOPHARMACOLOGY

Jointly with the Section of Medical and Veterinary Sciences

Chairman : DR. B. MUKERJI, Lucknow

1. DR. S. R. DASGUPTA (Calcutta) : *Central Actions of Chlorpromazine.*

Chlorpromazine (CPZ) exhibited a variety of actions indicative of 'Central' activity. No pharmacological basis however was available for these 'Central' actions. Experiments carried out by the present author and his colleagues have produced evidences in support of the 'Central' actions of the drug. His own work and the work of others have been reviewed in this paper and the conclusions are very briefly stated hereunder.

1. CPZ has a pronounced depressant action on the posterior hypothalamus and the facilitatory mesodiencephalic reticular formation, especially the cephalic portion.

2. The posterior hypothalamus and the rostral end of the midbrain reticular formation appear, from these experiments, to act as one functional unit.

In other words, the depressant activity of CPZ on the CNS appears to be limited to the meso-diencephalic reticular formation and its sphere of influence.

3. It also appears that subcortical structures play an important role in producing an integrated pattern of activity. The cortex also seems to stabilise the lower centres by keeping it facilitated against the action of CPZ.

4. Depressant effect of CPZ weakens as one proceeds down the axis and practically disappears in the spinal cord.

5. The posterior hypothalamus and the cephalic RF are the structures responsible for the egotropic activity (HESS). By depressing these structures CPZ suppresses all ergotropic activity and converts the animal into a trophotrope, whereby it will be organised for prevention or repair of wear and tear and for maintenance.

6. In the areas rostral to the posterior hypothalamus, CPZ does not appear to possess any depressant action. Moreover, in the "Cerveau isole" preparation, changes in the EEG characteristic of petitmal epilepsy have been recorded. In "pyramidal cats" epileptiform convulsions developed following CPZ. All these indicate an abolition

7. Killam & Killam (with whom the present author was associated) studied the effect of small doses of chlorpromazine (CPZ) on evoked potentials, through multiple electrodes in the brain. A distinct fall in threshold for electrical stimulation in the reticular formation (RF), was recorded. It was also found that potentials recorded from the RF following either the stimulation of the sciatic nerve or the RF itself, showed a marked increment. An increase in the intra-reticular conduction was also noticed. Further, it was found that the usual effect of stimula-

tion of the cephalic end of the RF to reduce evoked potentials in response to 'Clicks' recorded from the cochlear and the geniculate nuclei, was markedly enhanced after 1 mg/kg of chlorpromazine.

The overall enhanced responsiveness of the reticular formation to sensory inflows and to direct stimulation, may have important implications as to a possible way in which chlorpromazine acts as a tranquillizing agent.

The reticular formation or pathways within it, has recently been shown to play an important role in determination of the degree of sensory input reaching the cortex. Potentials recorded at the earliest synapses in the classical sensory pathways are reduced by simultaneous stimulations of the RF and increased by lesions blocking this outflow. From available evidence, it appears logical to assume that this depressive influence represents a mechanism for filtering incoming information in favour of that to which attention is to be directed.

The sumtotal of the effect of chlorpromazine in minute doses is an increase in this filtering function of the reticular formation. In certain types of mentally disturbed patients, it may be possible that this very important filtering function of the RF is defective.

Failure of this faculty is likely to allow any number of sensory inputs to reach the cortex without any effective selection or control by the RF. Chlorpromazine, by enhancing the filtering mechanisms originating from the RF, may act to reduce the inflow of information lacking in importance to the organism, and thereby exert its clinical effects of quieting, i.e. "tranquillizing", the organisms.

2. DR. S. D. SINGH (Candigarh) : *Effect of stimulant and depressant drugs on conditioned emotional responses in rats.*

The present study aimed at investigating the effects of some stimulant and depressant drugs on the acquisition of conditioned emotional response (CER) in rats. The CER was defined in terms of a decrease in a stable lever pressing response in Skinner box in the presence of a light signal previously associated with electric shock. Two experiments were done. In the first, a group of 12 emotionally reactive and 12 non-reactive rats selected on the basis of their defecation scores in a standardized open-field test served as subjects. All these Ss were randomly allocated to six different treatment groups, this four Ss in one group, two of them being emotional and two non-emotional. The one group of Ss was given four emotional conditioning trials under the influence of 15 mg./Kg. of amylobarbitone, a central depressant; the second group, under the influence of 10 mg./Kg. of pipradrol, a central stimulant; the third group, under the influence of 100 mg./Kg. of chlorpromazine, an autonomic depressant; the fourth group, under the influence of 5 mg./Kg. of ephedrine hydrochloride, an autonomic excitant; the fifth group, under the combined influence of 10 mg./Kg. of pipradrol and 5 mg./Kg. of ephedrine; and the sixth group, under the combined influence of 15 mg./Kg. of amylobarbitone and 100 mg./Kg. of chlorpromazine. All the drugs to the respective group subjects were injected intra-peritoneally. After the conditioning trials, six test trials were given in the Skinner box, one trial per day.

In general, the results showed that the formation of the CER can be modified by drugs. The stimulant drugs produced stronger CER than the depressant drugs. It was, however, the centrally acting drugs, pipradrol and amylobarbitone, and not the autonomic drugs, ephedrine and chlorpromazine, which showed this effect. The centrally acting drugs seem to affect the CER formation more or less in the same way as they do eyelid conditioning. It was also found that the emotionally reactive and non-reactive rats react differently to drugs. The reactive rats seem to be more affected by the stimulant drugs, and the non-reactive ones by the

depressant drugs, and such differences seem to be more in case of the autonomic drugs. Only combination of the stimulant drugs showed an additive effect.

In the second experiment, antagonistic effect of two centrally acting drugs, pipradrol and amylobarbitone, on the acquisition of the CER both in emotional and non-emotional rats was studied. In brief this experiment was designed to answer two main questions: How does the CER conditioning reflect the possible antagonism of drugs, and; how is the antagonism of drugs affected by the emotional reactivity level of the subjects. Twenty four emotionally reactive and 24 non-reactive rats were used. The random assignment of the Ss to 12 experimental groups was carried out within the two groups of 24 reactive and 24 non-reactive Ss, four rats—2 reactive and 2 non-reactive in one treatment group. The group one was given four emotional conditioning trials under the influence of two placebo injections; group two, under the influence of one placebo and one amylobarbitone (15 mg./Kg.) injection; group three, under the influence of 15 mg./Kg. of amylobarbitone and 2.5 mg./Kg. of pipradrol; group four, under the influence of 15 mg./Kg. of amylobarbitone and 5 mg./Kg. of pipradrol; group five, under the influence of 15 mg./Kg. of amylobarbitone and 20 mg./Kg. of pipradrol; group six, under the influence of 15 mg./Kg. of amylobarbitone and 40 mg./Kg. of pipradrol; group seven, under the influence of placebo and 10 mg./Kg. of pipradrol; group eight, under the influence of 10 mg./Kg. of pipradrol and 3.75 mg./Kg. of amylobarbitone; group nine, under the influence of 10 mg./Kg. of pipradrol and 7.5 mg./Kg. of amylobarbitone; group ten, under the influence of 10 mg./Kg. of pipradrol and 30 mg./Kg. of amylobarbitone; group eleven, under the influence of 10 mg./Kg. of pipradrol and 60 mg./Kg. of amylobarbitone. All the injections were given intraperitoneally, keeping the aqueous volume same for all the injections. After the conditioning trials, six test trials were given in the Skinner box, one trial a day.

Despite the rather small numbers in each treatment groups in this experiment, the results clearly showed that the CER formation can, within certain limits, be progressively increased or decreased by the antagonising effects of gradually increasing doses of a central stimulant or depressant drug on a fixed dose of the other drug. Indeed, the largest dose of amylobarbitone almost blocked the formation of the CER completely. These findings provide an additional support to the growing evidence that conditioning in general is a function of the postulated cortical excitation-inhibition balance, which can be, in turn, affected by drugs. The results also showed a significant effect of the emotionality level of the rats on the antagonism of these two used drugs. The suppression of pipradrol by amylobarbitone seems to be more effective among the non-reactive rats, while, upto a point, that of amylobarbitone by pipradrol is more effective among the reactive subjects.

In general, the results suggest the significance of emotionality trait in response to drug effects.

3. SRI N. CHATTERJI (Calcutta) : *Psychopharmacology of phenothiazine drugs.*

There are three main classes of phenothiazine drugs, the promazine, Prochlorperazine and mepazine groups. Chlorpromazine is the first drug that created sensation in the psychiatric world. Hammon and Daily showed its efficacy in controlling mood variation in manic depressive psychosis. Deschamps found it to be efficacious in controlling hallucinations of schizophrenia. In my cases it gave very good result in catatonic variety of schizophrenia. Triflupromazine is more efficacious in schizophrenia than chlorpromazine but in manic depressive group it appears to be less effective. Promazine, another drug of promazine group works exactly like chlorpromazine but is less efficacious.

In the perazine group we have prochlorperazine and trifluoperazine. Brodie found this drug to be very efficacious in controlling excitement. Excellent results were also obtained in paranoid schizophrenia and hallucinatory case. In my 66 cases treated with this drug I found it has got a special property to combat delusions and hallucinations. Walter Krase reported the remarkable effect of trifluoperazine in arresting hallucinations in schizophrenia.

Freyman from his observations of his treatment of psychotics with mepazine found that it produces very little clinical results. Braum said that mepazine alone was of no value in schizophrenia but when it was administered with prochlorperazine the result was remarkable.

Attempts have been made to explain the actions of phenothiazine drugs physiologically. Hess says impulses from body, consciousness and viscera pass into either an ergotropic or trophotropic coordinating systems making the sympathetic or parasympathetic system dominant. Brodie believes that two specific neurohormones must be concerned in the passage of and accurate separation of impulses in two systems. There is evidence to suggest that the neurohormones concerned with the trophotropic system is serotonin and with the ergotropic system is noradrenaline. Both the hormones are found in bound form in hypothalamus and phenothiazine drugs acting on the centre interferes with the concentration of the hormones and brings about a change in the psyche of the patients.

4. SRI T. R. KULKARNI (Bombay) : *Scope for psychopharmacological studies in Yoga.*

Attempt has been made in the paper to throw light on certain trends in ancient Indian thought which permit an analysis of human behaviour conforming to general empirical principles. It has been shown that if worked out in detail these trends hold a promise for a chemical theory of behaviour—a theory which, at present, seems to be the leading edge of scientific advance in general, indicated by most of the current research. After a brief reference to the discovery of the drugs classified as psychotomimetics and the possible role which these drugs might have played in the evolution of human thought some Rigvedic ideas have been taken up for analysis. The chief among these ideas is the concept of the “propellant” (Agni). As conceived by the Rigveda the “propellant” is an energy generated by psychochemical processes. It is envisaged that the psychical factors involve the chemical and vice-versa. These psychochemical factors are said to operate in two antagonistic ways, one related to the breaking up and the other to the rebuilding of the ‘propellant’. The former is associated with states of non-cognitive and the latter with cognitive states of activity. The Rigveda actually mentions one chemical substance viz. Soma which, according to it, is produced in the body. The properties of Soma as described therewith permit its being classified as a psychotomimetic and tranquillizer.

Effort has been made to trace the development of the same ideas in some Upanishadic texts and the Yoga Sutras of Patanjali. The significance of the ancient thought as outlined is explained by introducing the terms psychosynthesis and psycholysis.

5. DR. N. MUKERJI (Bombay).

It is somewhat doubtful if these drugs alone could be held as solely responsible for producing the effects as suggested by the readers of the previous papers. The contribution of personality on the effect of drugs has yet to be recognized and finally analyzed.

6. DR. B. MUKERJI (Lucknow).

Certain new drugs have been introduced recently which are central N.S. depressants with distinct properties; (Hypnotics, anaesthetics, sedatives and narcotics act, mainly by depressing the cerebral cortex), but the new tranquillising agents act on regions below the cerebral cortex, perhaps in the region of the hypothalamus. An increasing amount of evidence supports that the tranquillising agents or ataraxics depress the activity of the reticular formations of the brain and spinal cord. The reticular formations are believed to contain centres which control vomiting, heat-regulation, wakefulness, vasomotor tone, voluntary muscle tonus, secretion of anterior pituitary, etc. A general depression of this region or regions should therefore evoke far-reaching response. Dr. Pabing, in 1955, suggested that the tranquillising drugs be called ataraxics or ataractic drugs (from the Greek ataraxia—"freedom from disturbance of mind or passion"). There appears to be minimal cortical or higher central depression, though agitated persons, under their effect, may go to sleep. Usually if the patient is depressed by these agents, he can be readily aroused with no interference with faculties of reason, intelligence or common sense. Increased dosage does not cause sedation like the barbiturates but rather increases the duration of the tranquillising effect. The two most prominent members of this group, whose site of action on the brain has led to these presumptions are *Rauwolfia* and *Chlorpromazine* or *largactil*.

There are a few compounds known as hallucinogens or psychomimetics for their hallucination producing property. Mescaline, the active principle from the dried tops of the Peyote cactus, bufotenine, the active principle from a South American plant, ergot and lysergic acid diethylamide have been found to produce hallucination. In 1940 Hoffman discovered that temporary mental changes could be induced by microgram quantities of the newly synthesized lysergic acid diethylamide (commonly abbreviated LSD from the German, *lyserg saure diethylamide*), which is the basic structural nucleus of the active ergot alkaloids. As a result of accidental absorption he experienced peculiar restlessness and dizziness—"a not unpleasant state of drunkenness, characterized by extremely stimulating fantasy, associated with an intense kaleidoscopic play of colors". A search for a common denominator among these chemicals, revealed the presence of an indole nucleus or an indole like structure. On this basis, the Canadian investigators Hoffer, Ormond and Smithies postulated that the discovery of compounds occurring in the body with an indole like structure would provide a vital clue to the aetiological factor in schizophrenia. Two such substances were offered as candidates to support this hypothesis; adrenochrome and serotonin. It has been observed by many clinicians that the injection of adrenaline produces a transient psychological disturbances, especially if the adrenaline solution is oxidized or shows a pink discoloration—indicating the presence of adrenochrome. Adrenochrome injected in human volunteers produced psychoses similar to those elicited by other hallucinogens. Thus it was postulated that some abnormality of adrenaline metabolism might result in excessive adrenochrome accumulation in the body, which would be responsible for mental aberration. The second candidate, a substance which occurs naturally in the body and displays the indole nucleus is 5-hydroxytryptamine—a metabolic oxidation product of the essential amino acid tryptophane. This substance has also been called serotonin. Serotonin is believed to be an important neurohumoral transmitter in the central nervous system, functioning in a manner similar to acetyl-choline. The hallucinogen LSD has been demonstrated to be a serotonin antimetabolite, capable of at least partially antagonizing the central and peripheral actions of this neurochromone. The deficiency of serotonin in the brain induced by LSD, most likely due to reduced serotonin synthesis, has been considered as a possible cause of the hallucinations observed following administration of LSD, and it was further suggested that some of the naturally occurring mental disorders might similarly arise from a lack of serotonin in the brain.

A considerable body of evidence has accumulated indicating that the tranquillizing effect of reserpine are mediated through the release of serotonin in the brain. Reserpine and serotonin share central and peripheral effects which are blocked by LSD. Reserpine releases serotonin from its binding sites in various body tissues including the brain. Only pharmacologically active Rauwolfia alkaloids possess the ability to release serotonin, whereas the commonly employed sedatives, hypnotics and narcotic analgesics do not. However several discrepancies have recently been noted which argue against complete acceptance of serotonin release as the major mechanism of reserpine-induced tranquillization. For example, serotonin is present only in extremely low concentrations in the brain, whereas large amount of exogenous serotonin are required to elicit significant pharmacological effects. Even the administration of large doses of serotonin to schizophrenic patients has been of little or no benefit. This may, of course, be related to inadequate transport across the blood brain barrier. In addition, the 2-bromo derivative of LSD, like the parent molecule is a potent serotonin antagonist but does not share the characteristic hallucinogenic activity of LSD. This further indicates that disturbances in serotonin metabolism may only be coincidentally involved in the mental changes produced by ataractic and psychomimetic drugs. This present consensus favours serotonin release by reserpine to be responsible for certain side effects associated with the administration of reserpine such as conjunctival and nasal congestion, increased gastrointestinal motility and possibly hypersecretion. Other rauwolfia alkaloids—iso-reserpine, isoraunescine, methyl reserpate, reserpic acid, reserpinine, serpentine, ajmaline, and ajmalicine—do not exert a sedative action and do not influence the serotonin concentration. Chlorpromazine, which has a direct effect on peripheral nervous structures as well as on the central nervous system, does not affect serotonin concentration in the brain.

I. PRESENT TREND IN THE APPLICATION OF SEMI-CONDUCTORS

Section of Engineering & Metallurgy

Chairman : PROF. H. N. DAS GUPTA.

Dr. S. S. Banerjee (Banaras) inaugurated the symposium while Shri Amarjit Singh (Pilani) read the following paper on the "Use of Solid State Devices as Low Noise Amplifiers" :

Solid State devices have opened up new frontiers in low noise amplifiers. They now represent an undisputable choice, where the lowest possible noise figures are imperative, as in the case of certain applications in the field of Radio Astronomy and of artificial satellites.

The two main categories of these devices, namely solid state masers, and parametric amplifiers are described. In both the cases, the properties of bound electrons are made use of rather than those of free electrons. Also the source of power for amplification, is an R.F. source, rather than a D.C. source. The solids can be used at low temperature, and this extremely low noise figures can be obtained.

The operation of the three level solid-state-maser is discussed in detail. The population density of electrons in a higher state, is artificially increased by applying a pump signal. Then some of the electrons are stimulated to return to an intermediate state, giving radiation at the required frequency.

In a parametric amplifier the energy transfer from a source of R.F. 'pump' power to a required signal frequency, takes place through a variable energy storage element. The most common methods of changing a reactive parameter using a

solid state device, are those involving in a ferrite or variation of capacitance of a reverse biased junction diode. The principles of operation are discussed in the two cases. Some of the fundamental power relations are given.

Results obtained in typical solid state masers and parametric amplifiers are given. A comparison is made with other low noise amplifiers.

A discussion followed in which Shri Rajendra Vikram Singh (Mussoorie), Shri S. Srinivasan (Bombay), Dr. K. S. G. Doss and Shri P. Malhotra participated. The participants put questions to Shri Amarjit Singh to all of which he furnished replies as shown below :—

(Rajendra Vikram Singh, Mussoorie)—The low noise figures of masers are of great importance to satellite relay communications systems because the high noise of terrestrially located antennas is avoided with the passive reflector satellite in cold space.

I agree with the observation.

(S. Srinivasan, Trombay)—(1) What is your opinion about using parametric amplifiers using Jn. diodes for amplification of pulses having width of the order of 0.1μ Sec. to 1μ Sec.? (2) What Jn. diodes do you think can be used for the above purpose to get maximum amplification?

In this case a wide band amplifier with band width extending up to a few megacycles is called. It is not particularly easy to get wide band performance in parametric amplifiers. Besides this, at these frequencies, low noise triodes perform pretty well. The use of parametric amplifiers for this application would not be very profitable to the present state of the art.

(K. S. G. Doss, Karaikudi)—Is there any connection between “lasser” and “maser” action?

“lasser” is the optical frequency analogue of “maser”, and has high potentialities on account of the coherence of the light waves generated. The waves can thus be focussed into extremely narrow beams.

(P. Malhotra, New Delhi)—Does the pumping frequency has to be square wave, if so what is the effect of rise and fall on the gain?

The pumping signal not have to be a square wave; and is in fact normally a sine wave. The square wave used in the figure, was only for the purpose of explaining the physical principle.

II. STANDARDISATION OF ENGINEERING EDUCATION IN INDIA

Chairman : PROF. H. N. DAS GUPTA.

In inaugurating the symposium, Shri A. Deb (Howrah) dwelt at length on the various aspects of engineering education, at present prevailing in the country and offered suggestions for standardisation in various stages. He appealed for unity in diversities. By instances, he showed how in West Bengal, polytechnics were controlled by Council of Engineering & Technical Education, in Bihar by Board of Technical Education, and in Orissa by Board of Engineering Education. The name of the controlling Board in the States can be standardised. The speaker put forward various arguments in support of his point that industry should not run their own technical schools for training their supervisors, but should draw their requirements of supervisory staff from polytechnics. The railways and the ordnance factories need not run their own schools. Instead, they should train the diploma holders from polytechnics for employment by them and by others. Education and training of engineers of all grades, was a joint responsibility of educational institutions and of industry and the goal would be reached through development of a closer and closer partnership between the two. The speaker mentioned about the future of those boys who passed from higher secondary schools with

technology but could not get admission in technical institutions. He also mentioned about the importing of theoretical education to factory workers. The collaboration of various curriculum followed in junior technical schools by Ministry of Education, vocational training course by Ministry of Labour, trade apprentice training in factories and night school course was urged. Men at the lowest rung should have facilities to fulfil their ambition of higher education, while in employment and to qualify for higher responsibility.

The speaker then dwelt on education at university level. In his opinion, all Indian universities should confer the same engineering degrees and not B.E. by one university and B.Sc. (Eng.) by another. Overlapping of syllabus was strongly stressed showing with concrete instances how a post-graduate in applied physics compared with a graduate in electrical engineering, how a diploma holder in mining compared with a mining engineering graduate. As a remedy, the speaker suggested more of elective subjects in engineering colleges and less of overlapping syllabus. The speaker mentioned how non-academic institutions vied with universities in awarding comparable degrees. He wished the Council of Scientific & Industrial Research intervened in the matter. The All-India Council for Technical Education should also exert more in an effort to stop overlapping of course and adoption of uniform syllabus and examination standard. The point of registration of engineers and formation of an Indian Engineering Council was also stressed. According to the speaker, the ratio of intake of students in engineering schools to intake of students in engineering colleges is incompatible and not at all balanced.

The speaker pointed out that engineers had one world as they had only one language, namely drawing. They had one international standard, and standardisation of their education in this country was long overdue.

A discussion followed as below :

A. Deb (Howrah)—I think that before starting thinking on the lines of standardisation of engineering education, the problem of finding and training suitable teachers should be considered. It usually happens that a fresher from college who has no experience at all, is teaching senior undergraduate and even post-graduate classes. Hence the problem of training teachers should be on the forefront. Practical knowledge of the various engineering branches is very essential for teachers at the undergraduate level.

G. C. Jain (Roorkee)—Unless the syllabus of study by students is standardised and the standard of examination throughout the country is made uniform, the curriculum for teachers training cannot be finalised.

The four higher institutes of technology can provide refresher courses for teachers. The teachers should be sent on deputation to industries also for gaining practical experience and keeping abreast of developments.

Shri R. M. Advani (Jodhpur)—(a) The Railway authorities are thinking of drawing persons for their Mechanical Departments from engineering colleges instead of running parallel courses at Jamalpur.

(b) The Jr. Tech. School scheme does not seem to be workable because it aims at training good technicians as also imparting good general and science education for being admitted to the second year of diploma which does not seem to be practicable.

(c) The diploma holder can obtain higher qualifications by appearing at Section A and B of AMIE.

Replying to the points raised by Shri R. M. Advani, Shri A. Deb said :

The sooner the industry do away with their own schools, the better for standardisation. Private sectors and also public sectors should not run parallel institutions when Universities/States are running their colleges/schools.

The junior technical schools are meant for providing theoretical education at skilled artisan level. These schools are run mostly by the industry for their

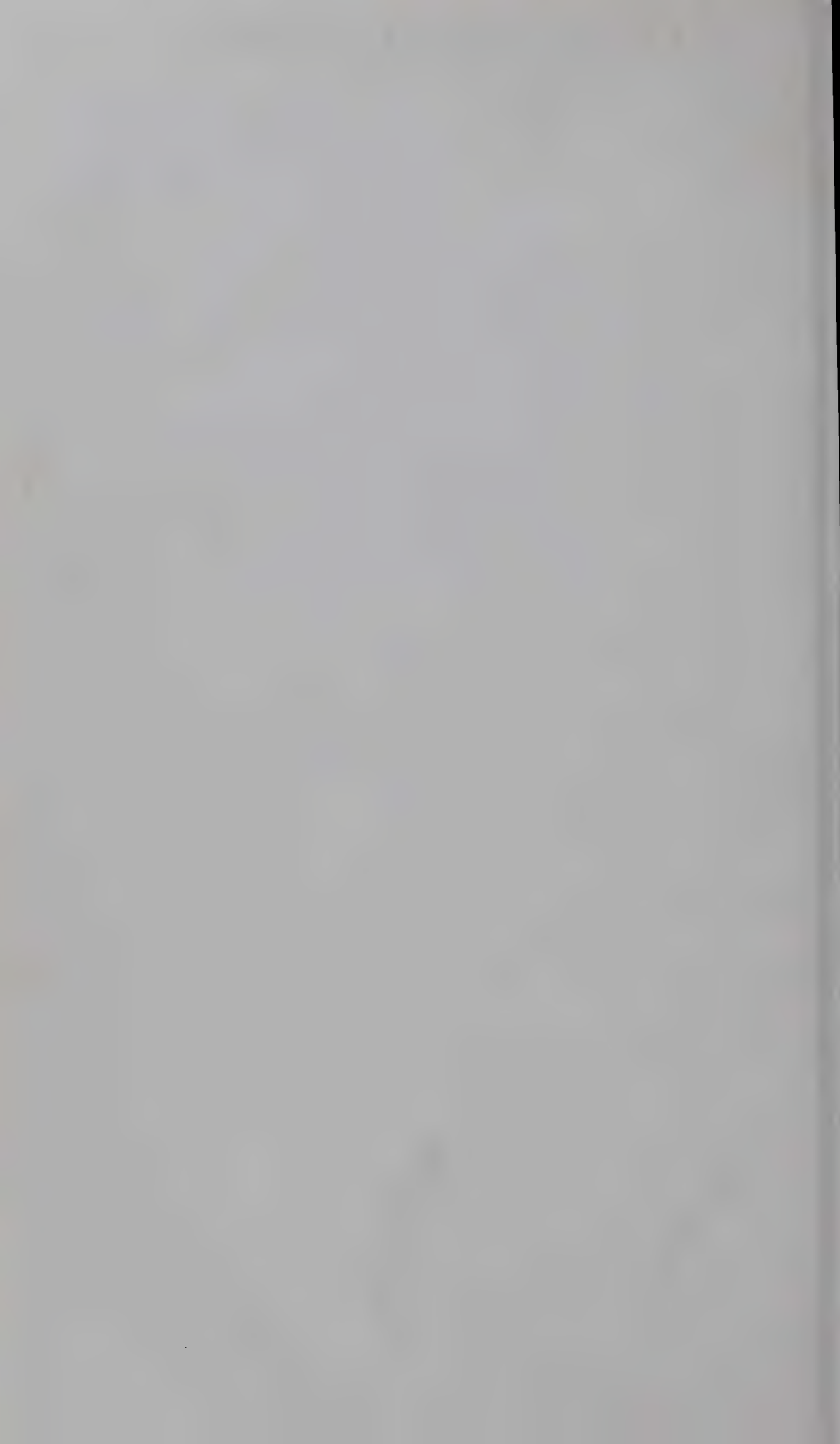
own employees. Workmen can attend night classes in these schools. Junior technical schools are aided by Ministry of Education. Vocational training course is run by Ministry of Labour. It is of utmost importance that there should be collaboration amongst various Ministries and private sectors to standardise the curriculum. The All-India Council for Technical Education can undertake the task. The training of workmen and artisans should receive due attention.

Education should be imparted by universities. Diploma holders can be offered opportunity to take up condensed course in engineering colleges to qualify for engineering degree. In U.K. 50% of graduates appear at external degree examination. The Government should not relegate the duty of providing scope for going in for higher qualification, while in employment or otherwise, to non-academic bodies.

H. E. Deger (Roorkee)—Let me first introduce myself to you. I am H. E. Deger, Visiting Professor of Mechanical Engineering at the University of Roorkee, under T.C.M. I have taught at the Universities of Illinois and Texas and I am here primarily concerned with the organisation of Teachers Training Programme, which I prefer to call Teachers Development Programme.

The subject of this afternoon's talk is interesting. Before attempting at the Standardisation of engineering education, I would rather lay more stress on the selection and training of suitable young men to take up teaching as a career. A few days back, at Delhi, I had an opportunity to interview some eighty aspirants to higher technical education in U.S.A. under T.C.M. fellowships. All of them were serving teachers and they represented a fair cross section of the country's engineering teachers. Believe me, the impression that they gave was extremely poor and disheartening. I hope Teachers Training Programme will go a long way to remedy the defect.

One of the speakers stressed the importance of devoting more attention to the standards of education in the schools and referred to the serious shortage of good teachers due to unattractive salaries offered. This problem is as acute in U.S.A. as it is in India. Youngmen and women, with lucrative jobs waiting for them in industry and business, have no compelling reason to take up teaching as a career. I hope this problem will receive due consideration in our countries.



APPENDIX



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